MANAGING DROUGHT

IN THE SOUTHERN PLAINS

May 10, 2012

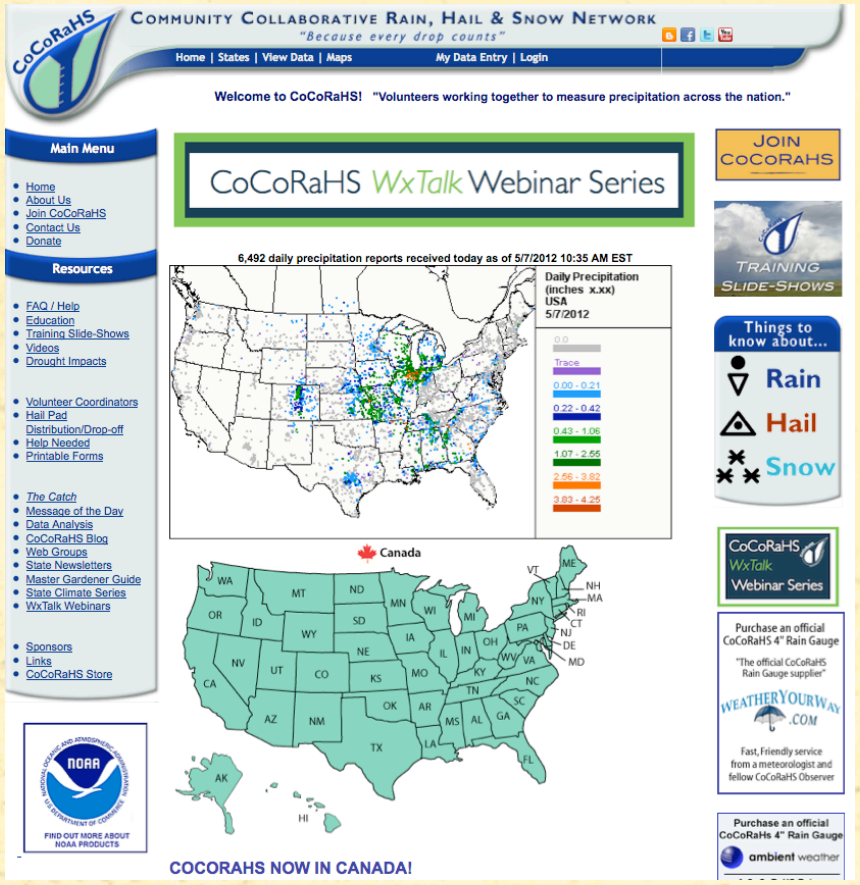
Upcoming Meetings

- 2012 Texas Water Summit
  - May 20-21, Austin
  - Goal: bring together scientists, engineers, policy analysts, legislators, CEO's and agency officials to develop a common understanding of the science, technology, economics and policy requirements needed to address Texas' emerging water security challenges.
  - More Information: http://www.tamest.org/events/2012-water-summit.html

- South Central Climate Science Center Roll-out meetings:
  - Houston/Galveston, June 12
  - More being scheduled
  - More information: http://southcentralclimate.org

CoCoRaHS

- http://www.cocorahs.org/
- Daily rainfall, hail & snowfall measurements from more than 12,000 volunteers across the country
- High-resolution, high-quality data for analysis of drought, floods, water supply, forecasting, education, mosquito control…
- All you need is a rain gauge!



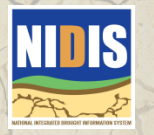
Coming Soon: The Hydrologic Cycle: http://www.youtube.com/cocorahs/

Regional Drought Monitor Update

Brian Fuchs, Climatologist

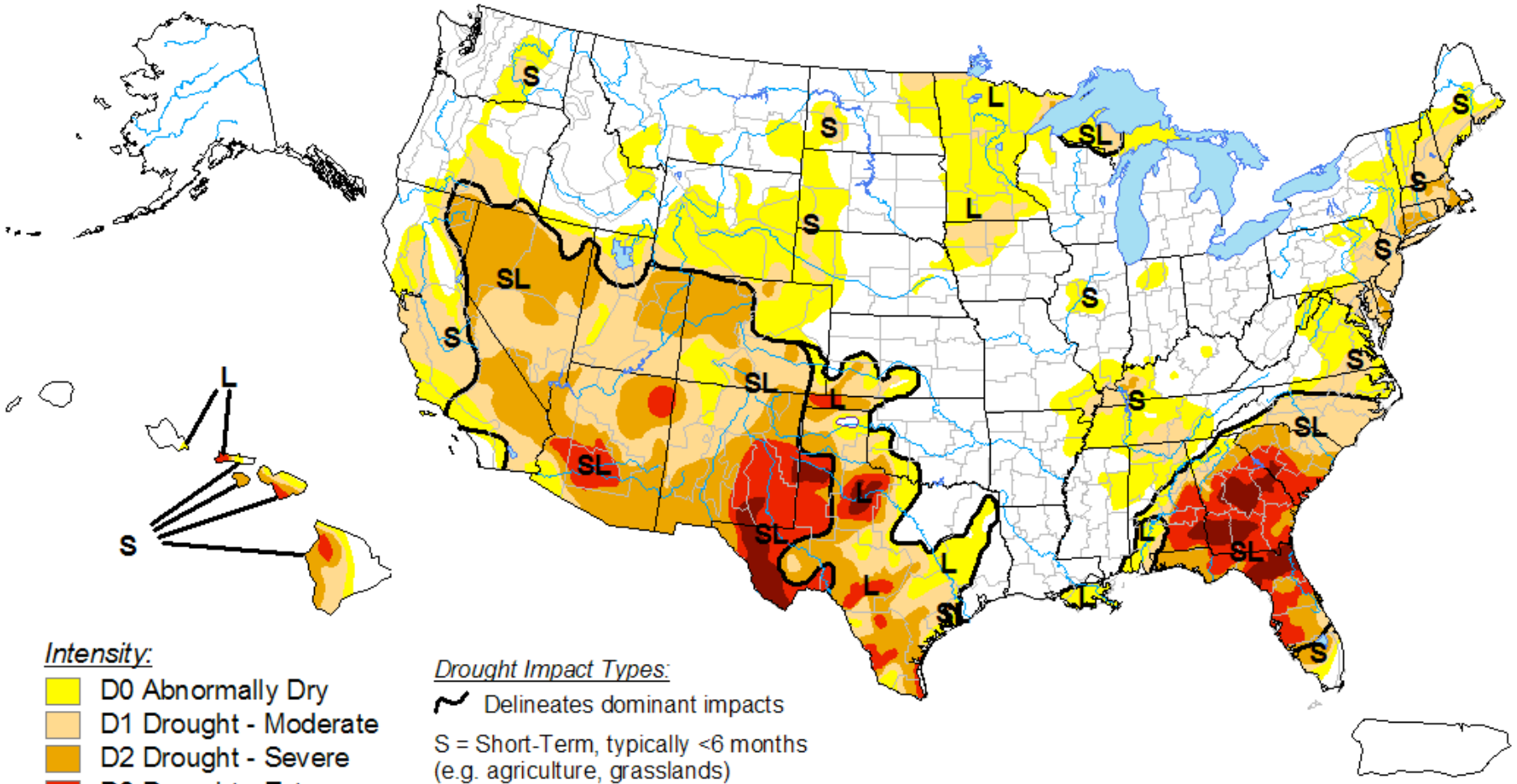
National Drought Mitigation Center
School of Natural Resources
University of Nebraska-Lincoln

SCIPP/NIDIS Drought Webinar Series, March 22, 2012



U.S. Drought Monitor

May 8, 2012
Valid 7 a.m. EDT



Intensity:
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:

Delineates dominant impacts

S = Short-Term, typically <6 months (e.g. agriculture, grasslands)

L = Long-Term, typically >6 months (e.g. hydrology, ecology)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://droughtmonitor.unl.edu/

USDA National Drought Mitigation Center

Released Thursday, May 10, 2012

Author: Matthew Rosencrans, NOAA/NWS/NCEP/CPC

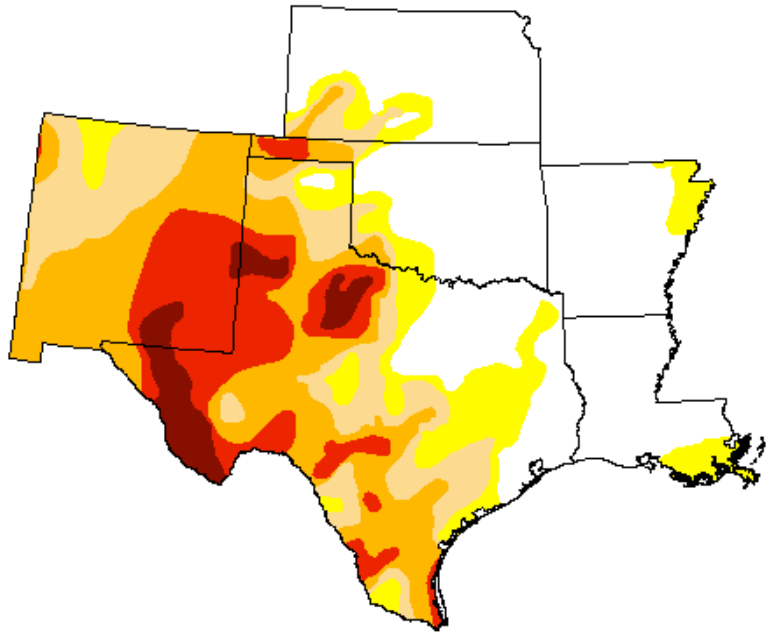
U.S. Drought Monitor

May 10, 2012
Valid 7 a.m. EST

South Central United States

Drought Conditions (Percent Area)

	None	D0 - D4	D1 - D4	D2 - D4	D3 - D4	D4
Current	39.71	60.29	48.49	34.42	15.33	3.72
Last Week (5/1/2012)	39.19	60.81	46.96	35.06	15.80	5.29
3 Months Ago (2/7/2012)	21.93	78.07	70.73	53.64	31.94	11.58
1 Year Ago (5/3/2011)	10.60	89.40	83.35	71.08	49.80	14.68



Intensity:

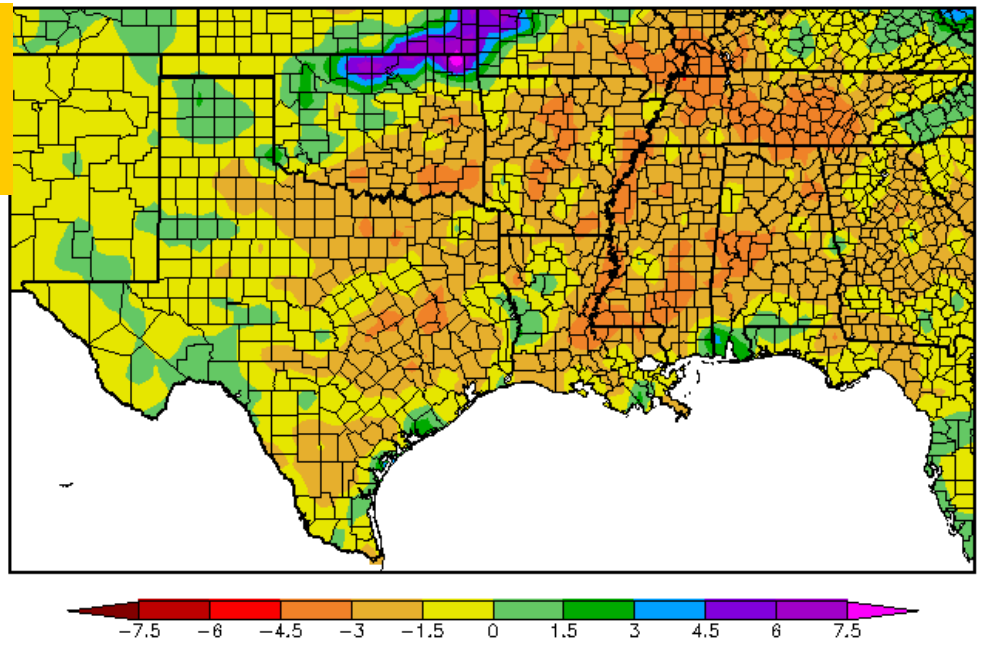
- D0 - Abnormally Dry
- D1 - Drought Moderate
- D2 - Drought Severe
- D3 - Drought Extreme
- D4 - Drought Exceptional

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forcast statements.

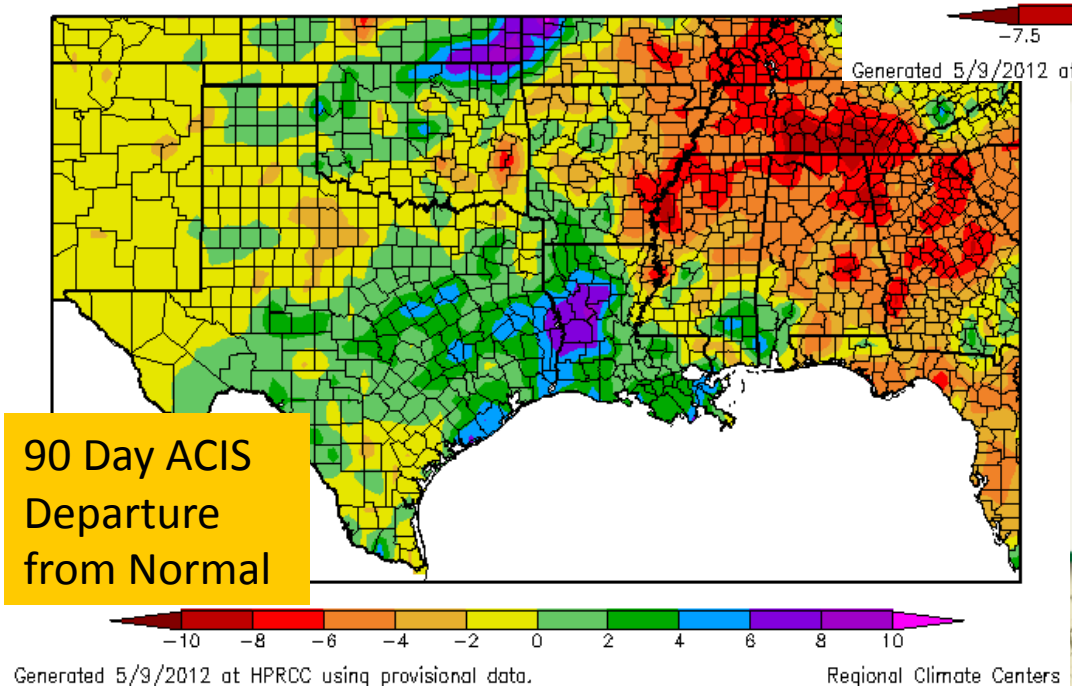
http://droughtmonitor.unl.edu

Released Thursday, May 8, 2012
Matthew Rosencrans,Climate Prediction Center/NCEP/NWS/NOAA

30 Day ACIS Departure from Normal



90 Day ACIS Departure from Normal

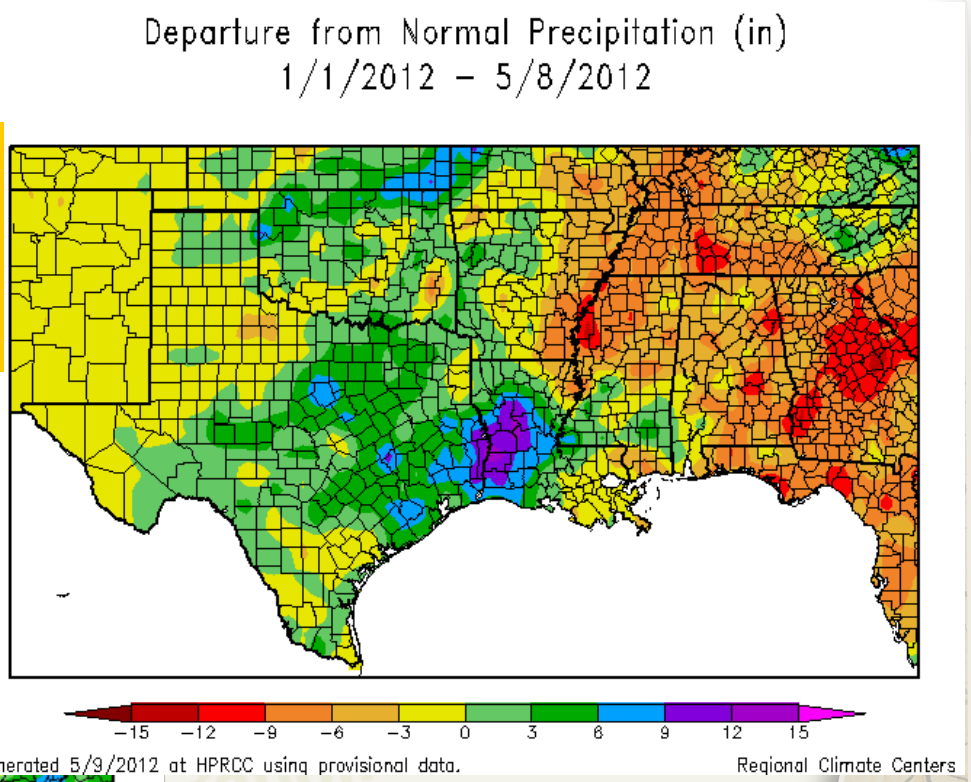


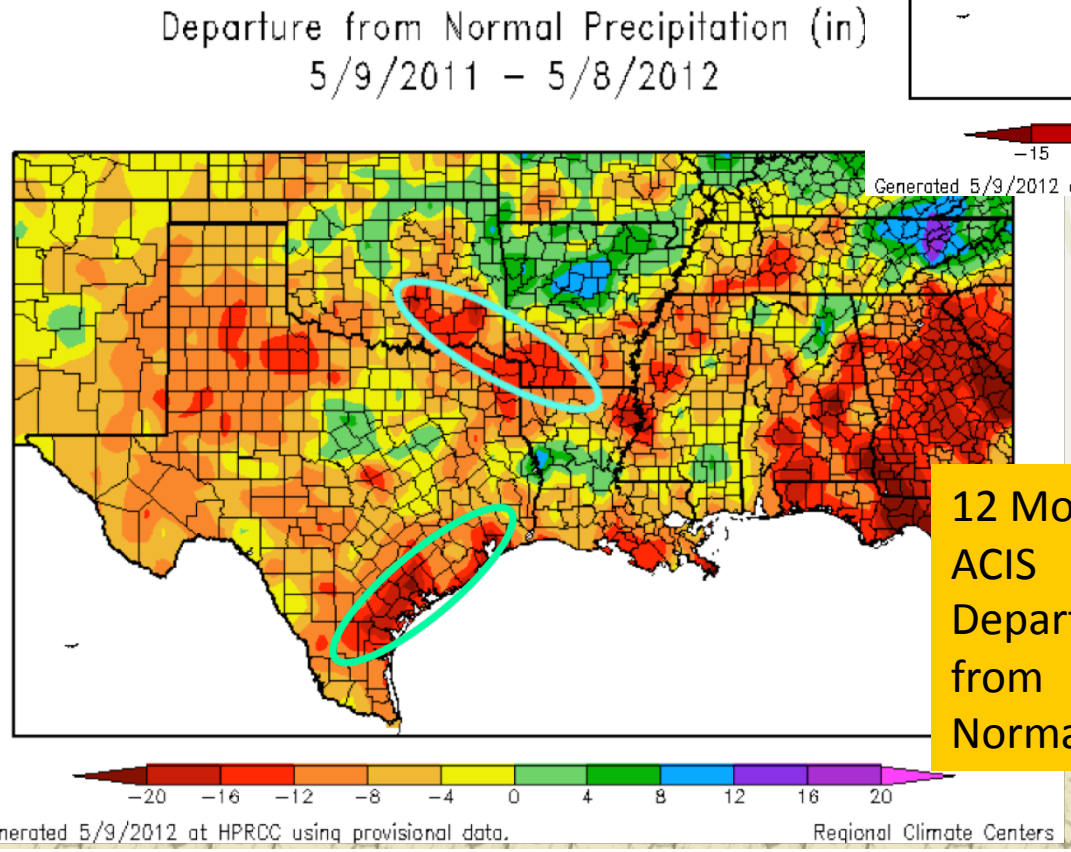
NIDIS

University of Nebraska Lincoln

National Drought Mitigation Center

Year to Date ACIS Departure from Normal





12 Month ACIS Departure from Normal

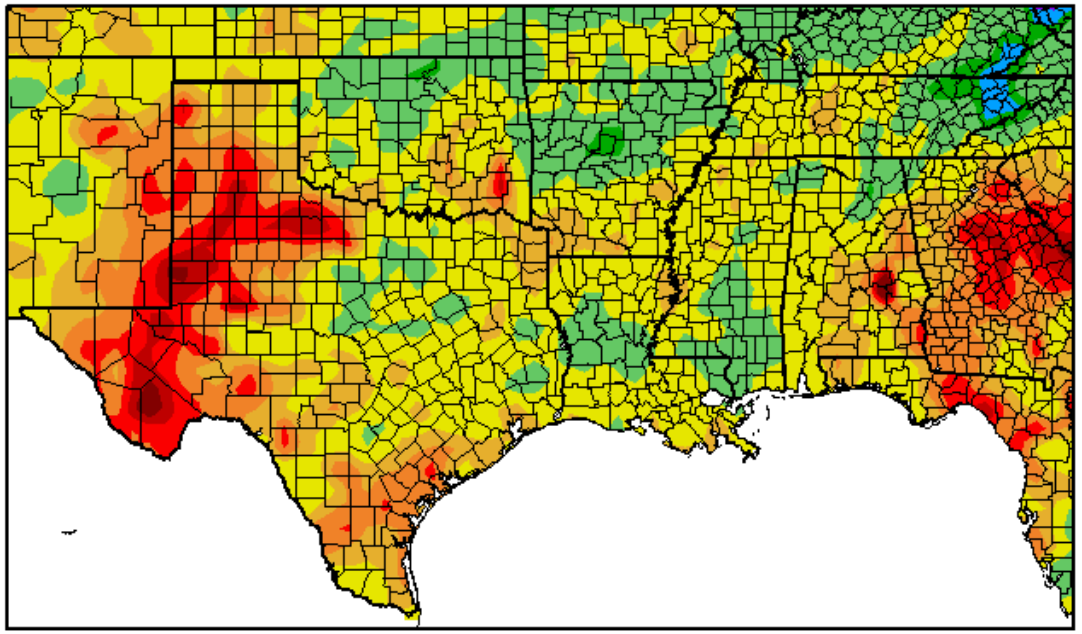
NIDIS

University of Nebraska Lincoln

National Drought Mitigation Center

Short-Term improvements versus Long-Term drought issues…..

12 Month SPI
5/9/2011 – 5/8/2012

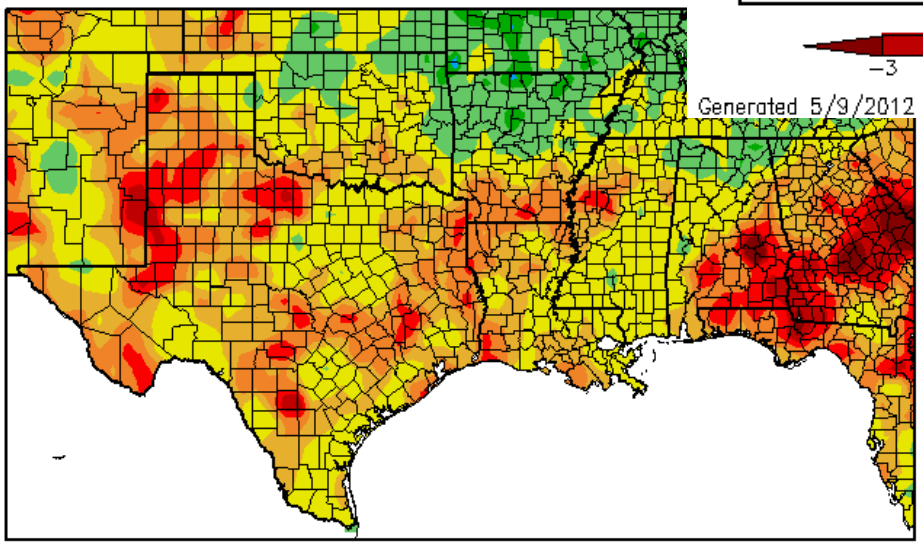


−3 −2.5 −2 −1.5 −1 0 1 1.5 2 2.5 3

Generated 5/9/2012 at HPRCC using provisional data.

Regional Climate Centers

24 Month SPI
5/9/2010 – 5/8/2012



−3 −2.5 −2 −1.5 −1 0 1 1.5 2 2.5 3

Generated 5/9/2012 at HPRCC using provisional data.

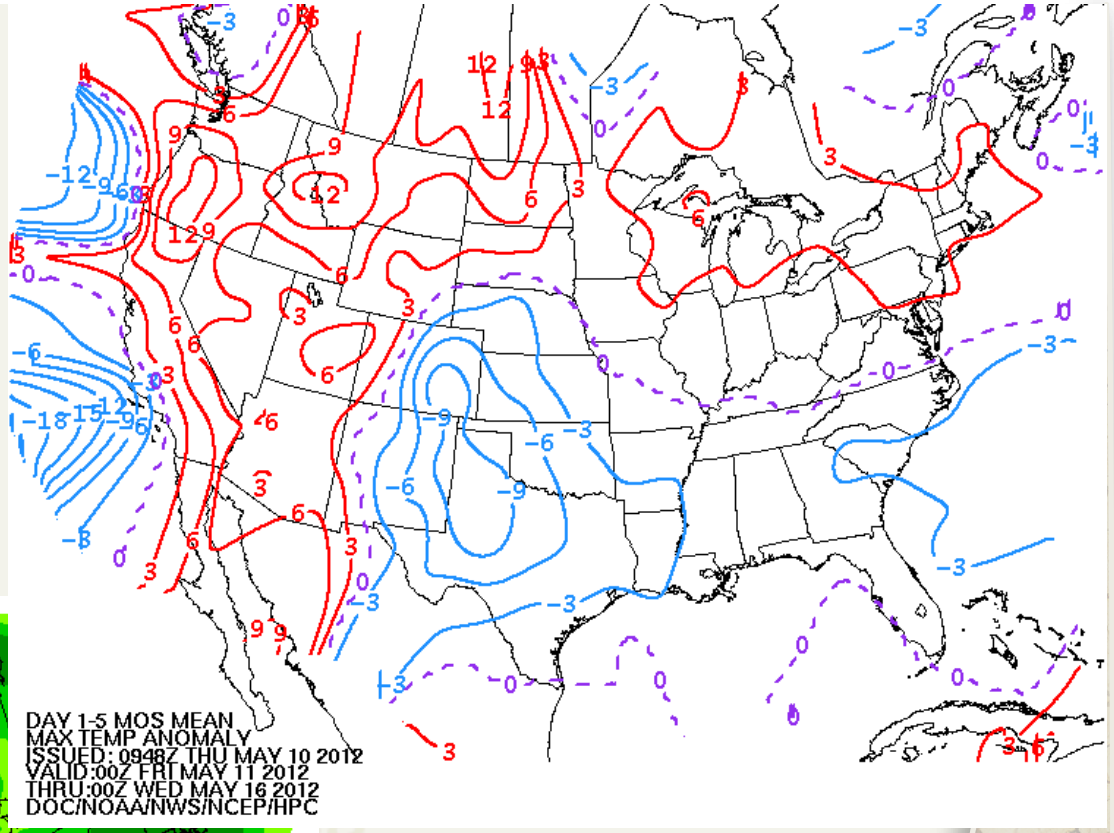
Regional Climate Centers

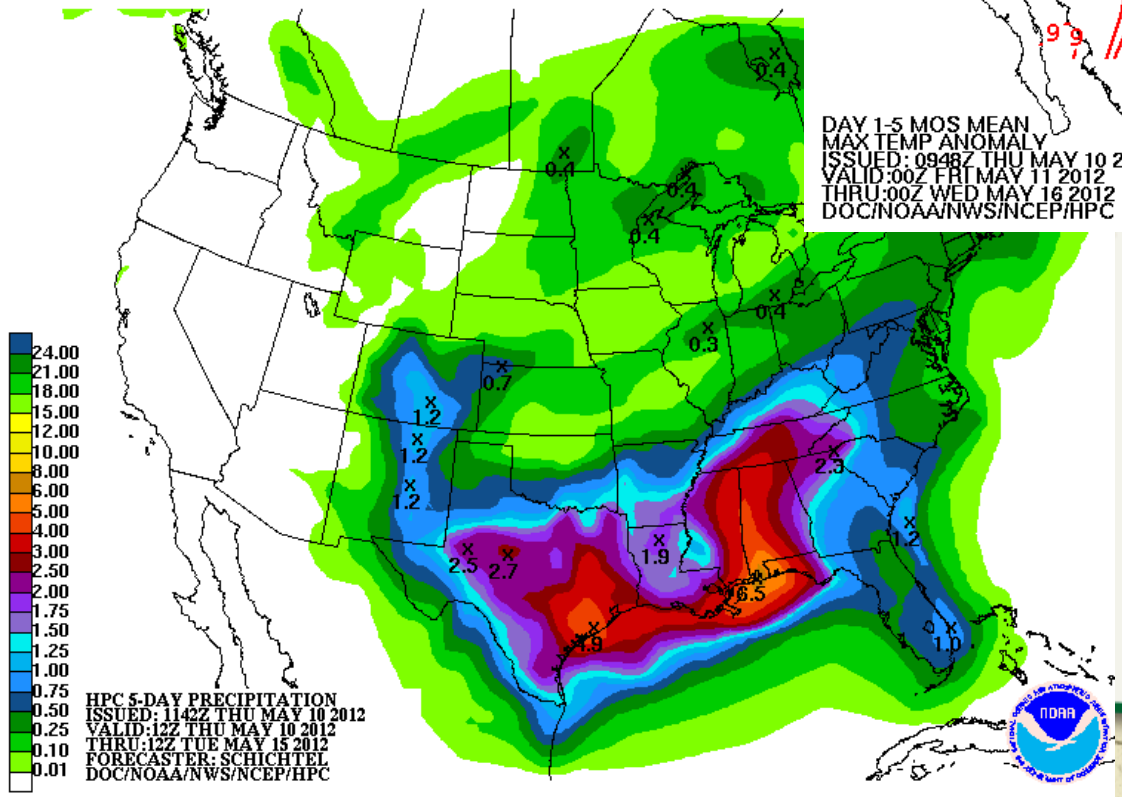
NIDIS

University of Nebraska Lincoln

National Drought Mitigation Center

HPC 5-Day Outlook



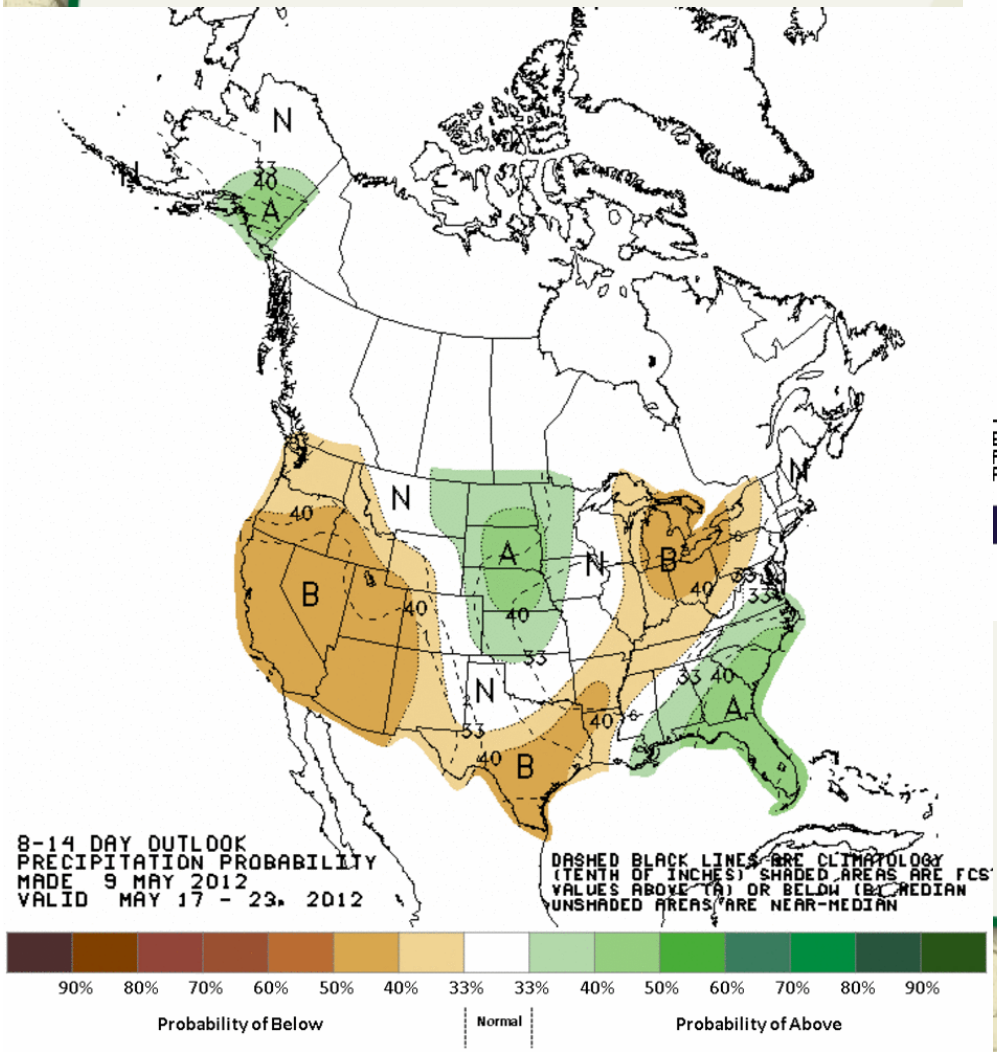


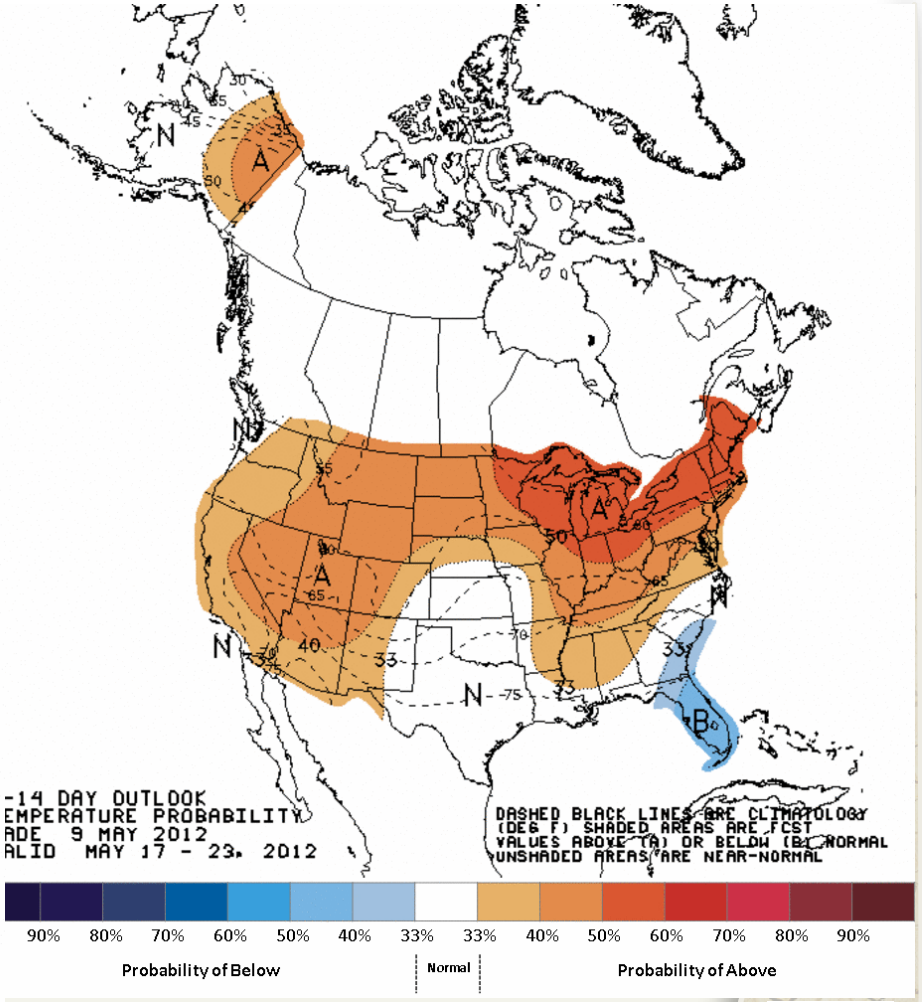
NIDIS

University of Nebraska Lincoln

National Drought Mitigation Center

CPC 8-14-Day Outlooks



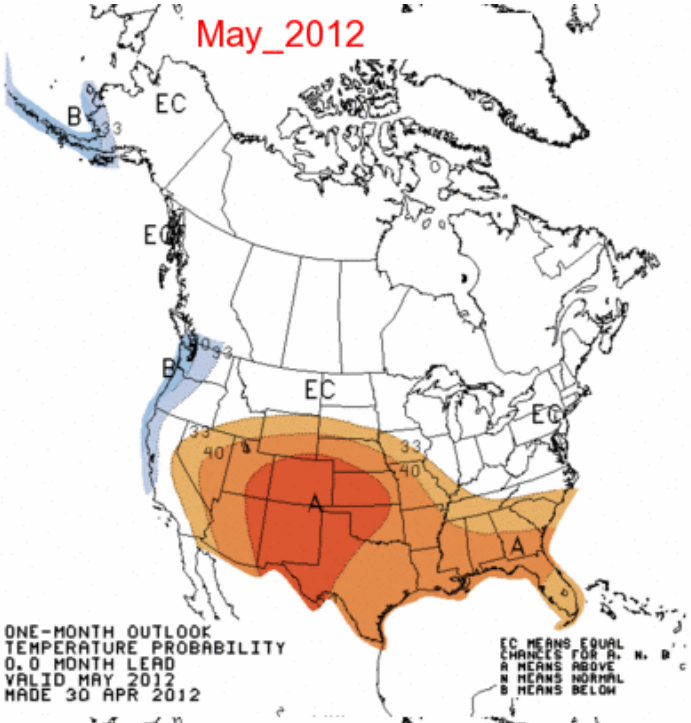


NIDIS

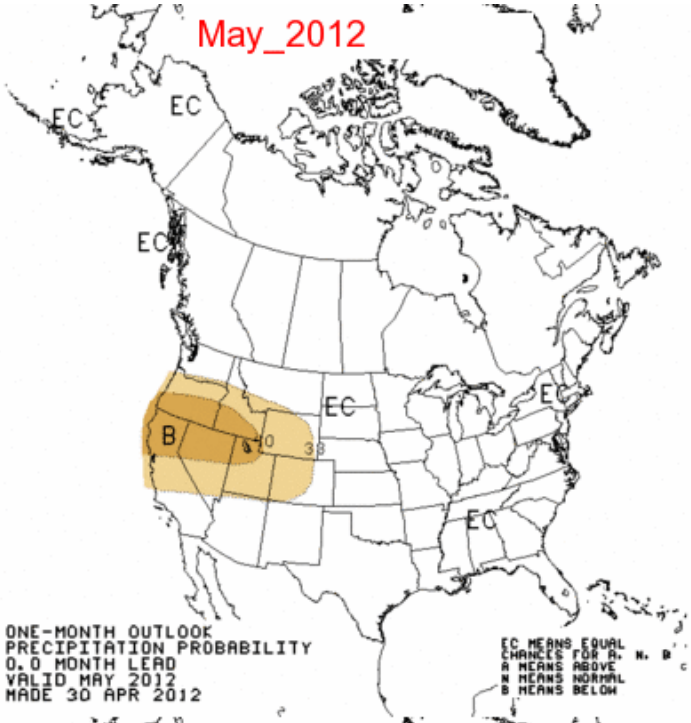
University of Nebraska Lincoln

National Drought Mitigation Center

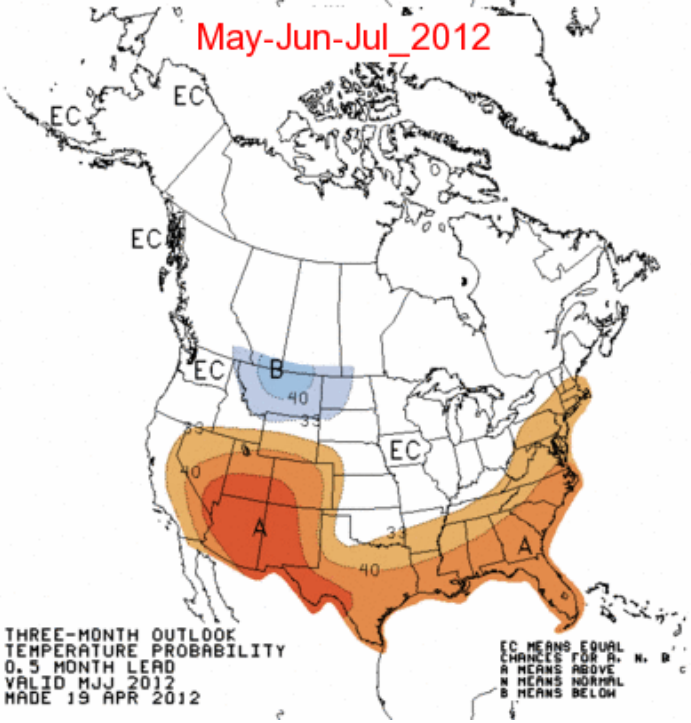
May_2012



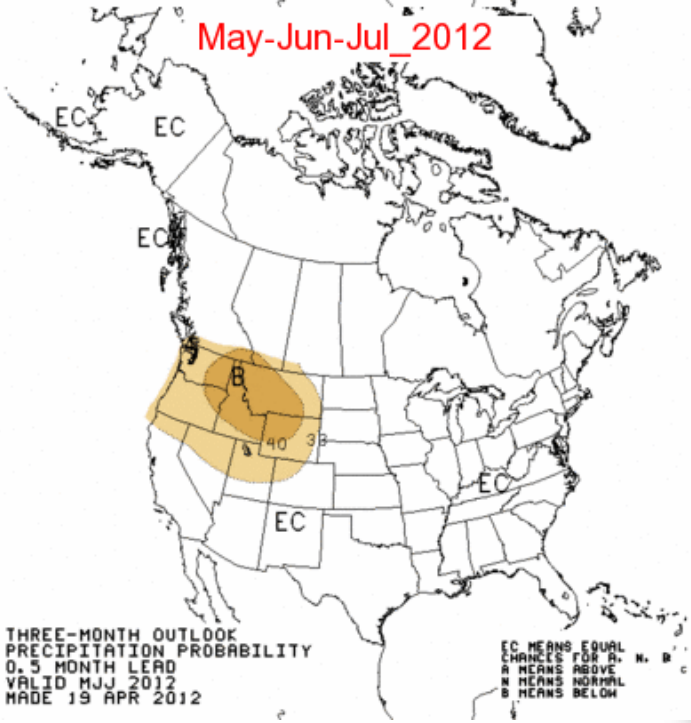
May_2012



May-Jun-Jul_2012



May-Jun-Jul_2012



NIDIS

University of Nebraska Lincoln

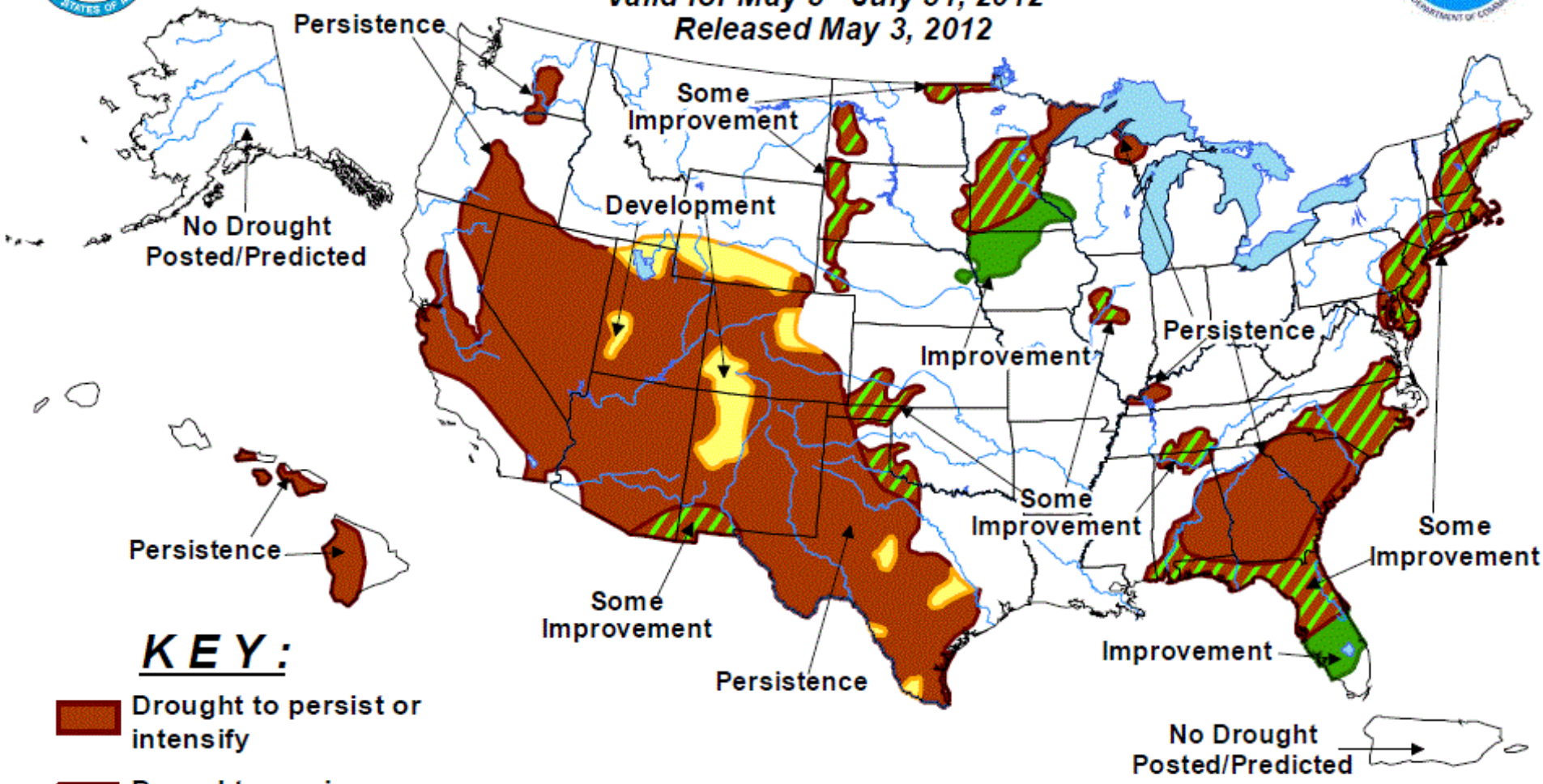
National Drought Mitigation Center

U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid for May 3 - July 31, 2012

Released May 3, 2012



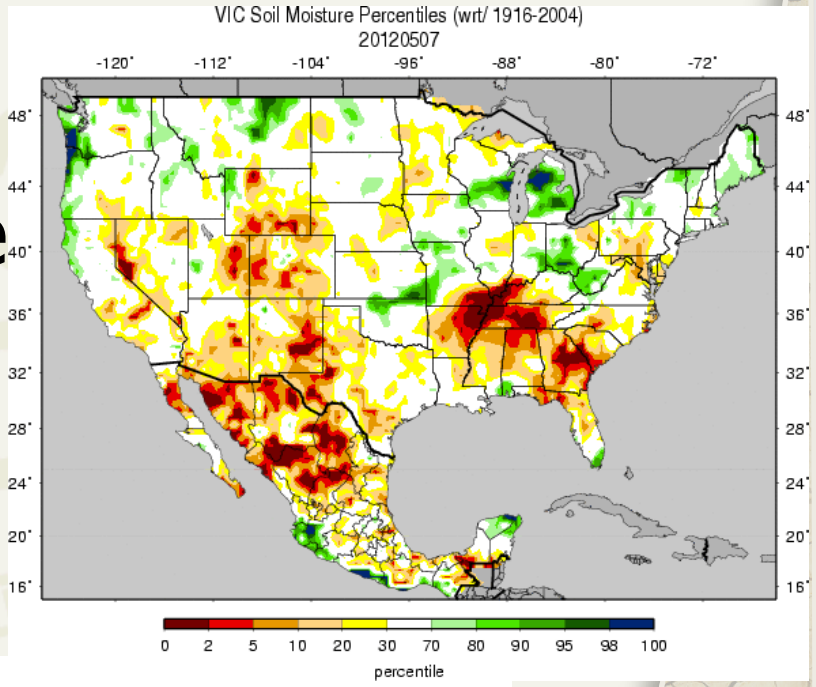
KEY:

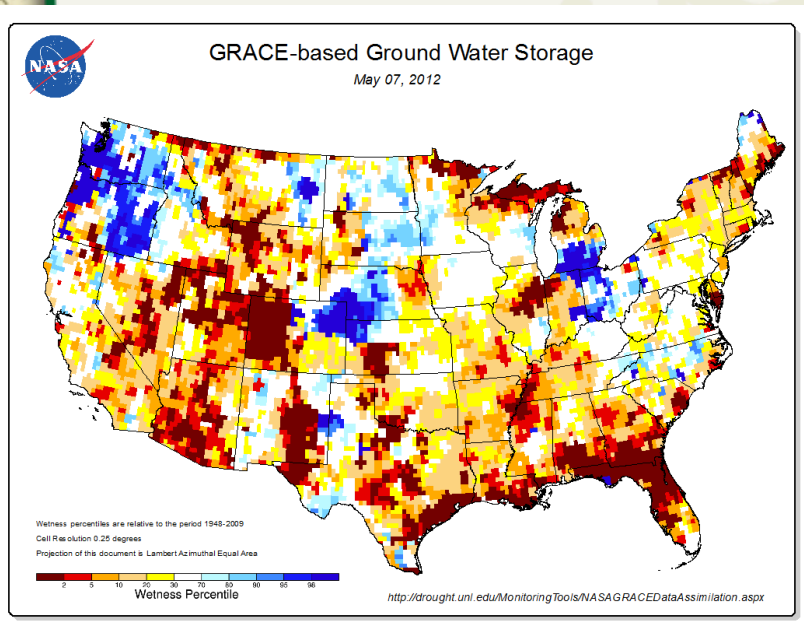
- Drought to persist or intensify
- Drought ongoing, some improvement
- Drought likely to improve, impacts ease
- Drought development likely

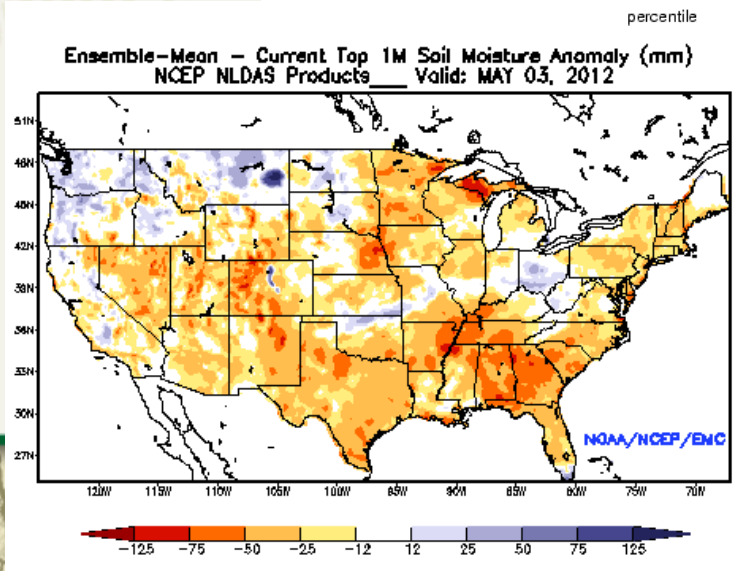
Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Short-term events -- such as individual storms -- cannot be accurately forecast more than a few days in advance. Use caution for applications -- such as crops -- that can be affected by such events. "Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4 intensity). For weekly drought updates, see the latest U.S. Drought Monitor. NOTE: the green improvement areas imply at least a 1-category improvement in the Drought Monitor intensity levels, but do not necessarily imply drought elimination.

What's new.....

- Products that help monitor soil moisture and groundwater conditions







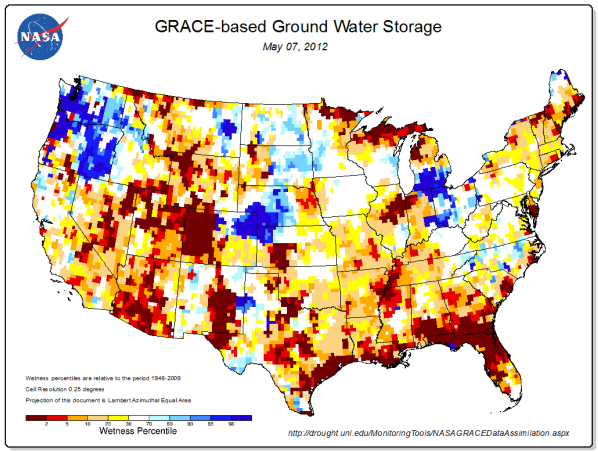
NIDIS

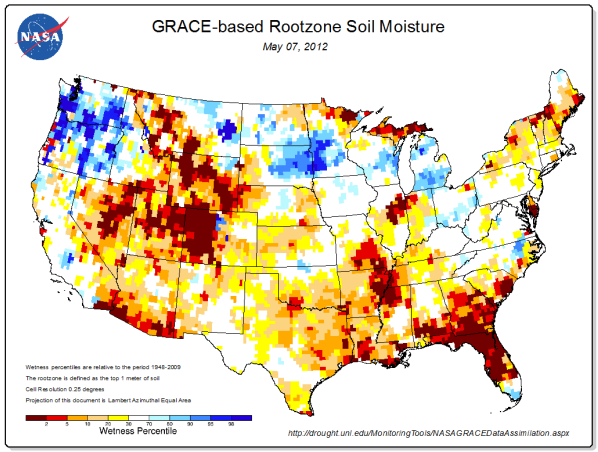
University of Nebraska Lincoln

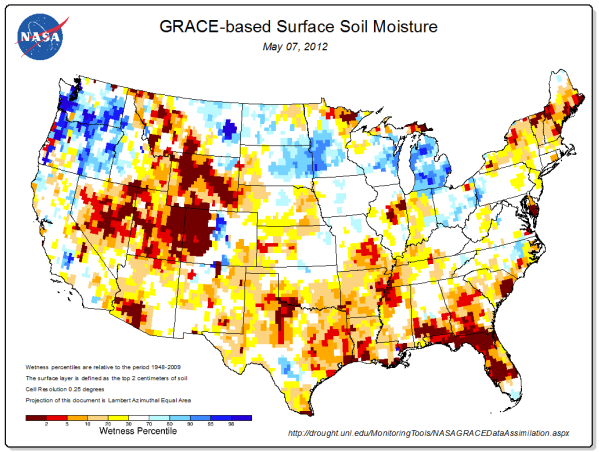
National Drought Mitigation Center

GRACE Data Assimilation

- Scientists at NASA's Goddard Space Flight Center generate groundwater and soil moisture drought indicators each week. They are based on terrestrial water storage observations derived from GRACE satellite data and integrated with other observations, using a sophisticated numerical model of land surface water and energy processes.
- These products are found at the National Drought Mitigation Center's webpage: **http://drought.unl.edu/MonitoringTools/NASAGRACEDataAssimilation.aspx**

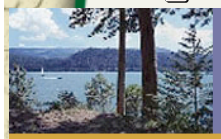






University of Washington Products using the VIC model

- http://www.hydro.washington.edu/forecast/monitor/index.shtml



Experimental Surface Water Monitor for the Continental U.S.

University of Washington

Home Info Links Contacts Disclaimer

Current Conditions
- VIC Plots
- MULTI-MODEL Plots
- Drought Indices
- MULTI-MODEL Drought Severity
- Data

Forecasts
- VIC ESP Plots

Archive (1915-present)
- SM & SWE Plots

Note: Popup blocking prevents Archive access

Powered by ACIS NOAA Regional Climate Centers

Current percentiles for soil moisture, SWE and other variables with respect to the climatological period (1916-2004 for CONUS and 1926-2004 for Mexico). These update daily by 11-12 pm PST, and have a lag of 1-2 days. **Roll the mouse over links below (or click) to see different maps**. *Note: SM & SWE maps are for daily values, whereas RO maps are for cumulative values.* SW Monitor description: (Wood, 2008)

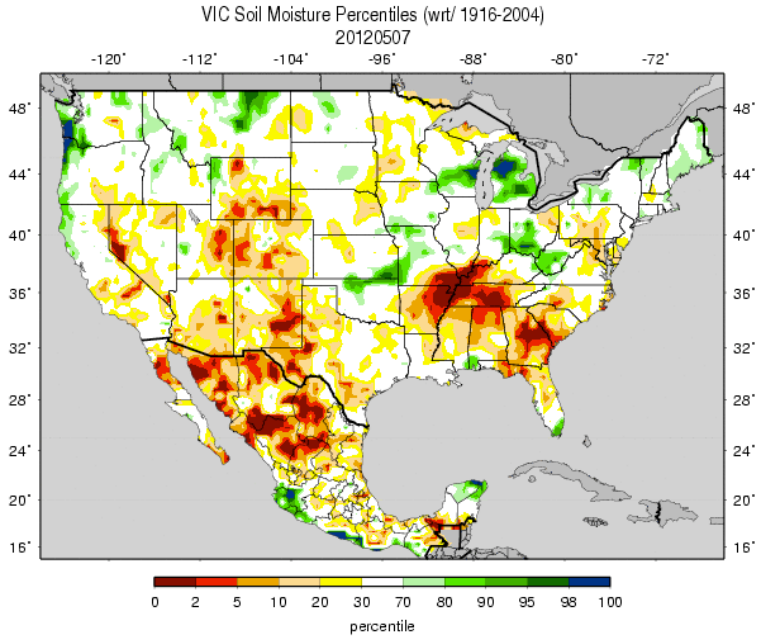
	Soil Moisture	SWE	Total Moisture Storage (SM+SWE)	Cumulative Runoff
Current Plots	~CPC [cmpr] ~DM [cmpr]	curr	curr	1mo 2mo 3mo 6mo 9mo 12mo 18mo 24mo 36mo 48mo 60mo WY
Recent Changes	1 wk 2 wk 1 mo	1 wk 2 wk 1 mo	-	

Regional Maps

SM: West Central East Washington State Page

Useful Links

-- DM/7-Day Streamflow mashup
-- DM Unified Blend / Change



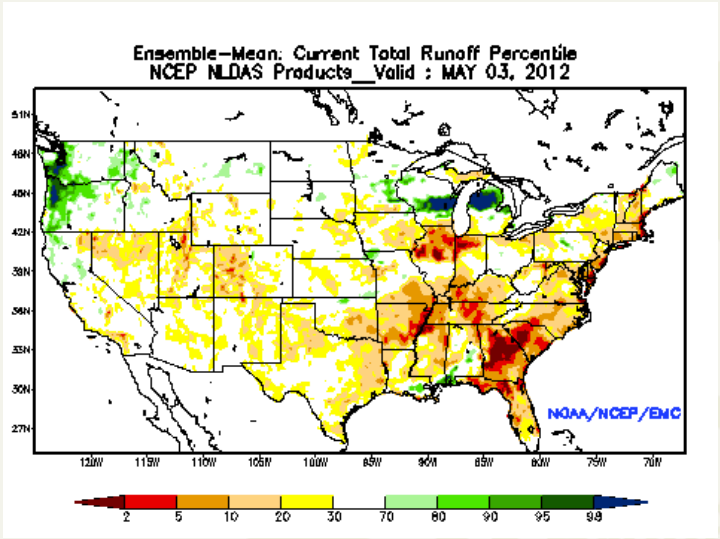
NIDIS

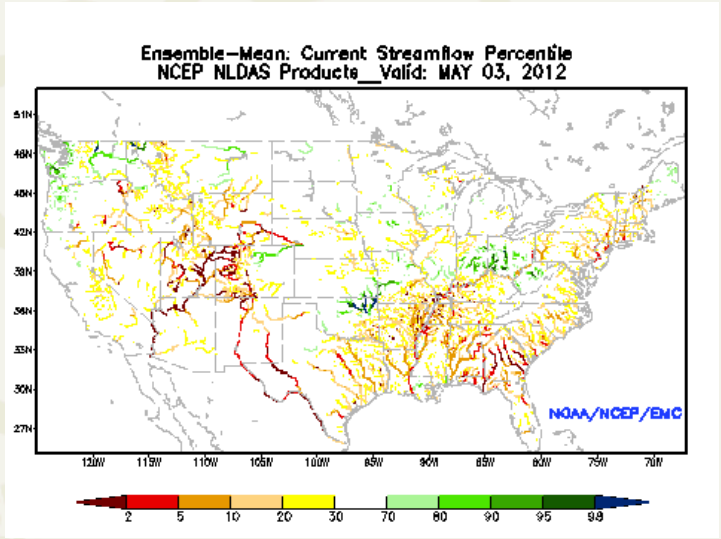
University of Nebraska Lincoln

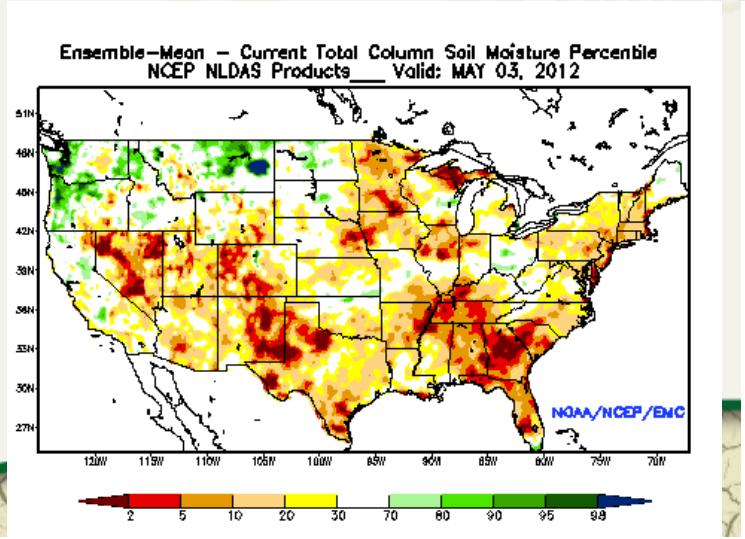
National Drought Mitigation Center

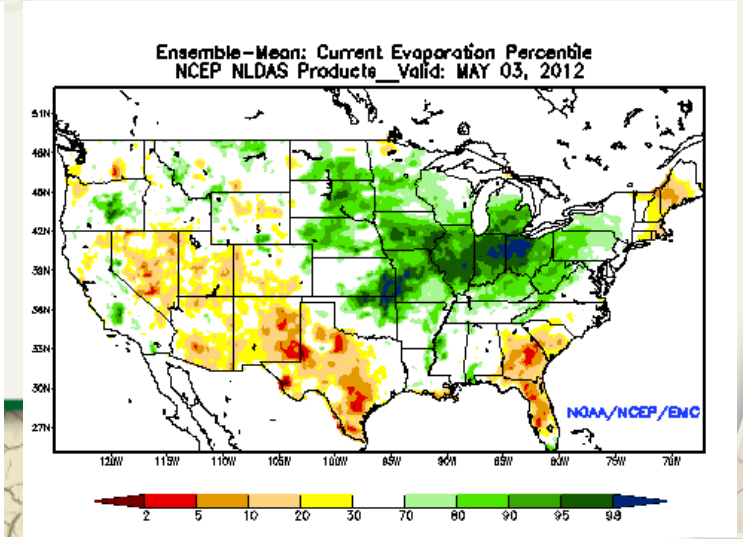
North American Land Data Assimilation System (NLDAS)

- http://www.emc.ncep.noaa.gov/mmb/nldas/drought/









NIDIS
University of Nebraska Lincoln
National Drought Mitigation Center

Contact Information:

Brian Fuchs
bfuchs2@unl.edu
402-472-6775
National Drought Mitigation Center
School of Natural Resources
University of Nebraska-Lincoln

Ground Water/Surface Water Interactions

Robert Puls, Ph.D.
Director, Oklahoma Water Survey

The University of Oklahoma

Oklahoma's Challenge

Increasing demands for sources of water, combined with changing land use, population growth, aging infrastructure, and climate change, pose significant threats to our state's water resources.

Failure to manage our state's waters in an integrated, sustainable manner will limit economic prosperity and jeopardize both human and aquatic ecosystem health.

The University of Oklahoma

Ground Water and Surface Water

Ground Water: Is often taken for granted because of "out of sight-out of mind mentality".

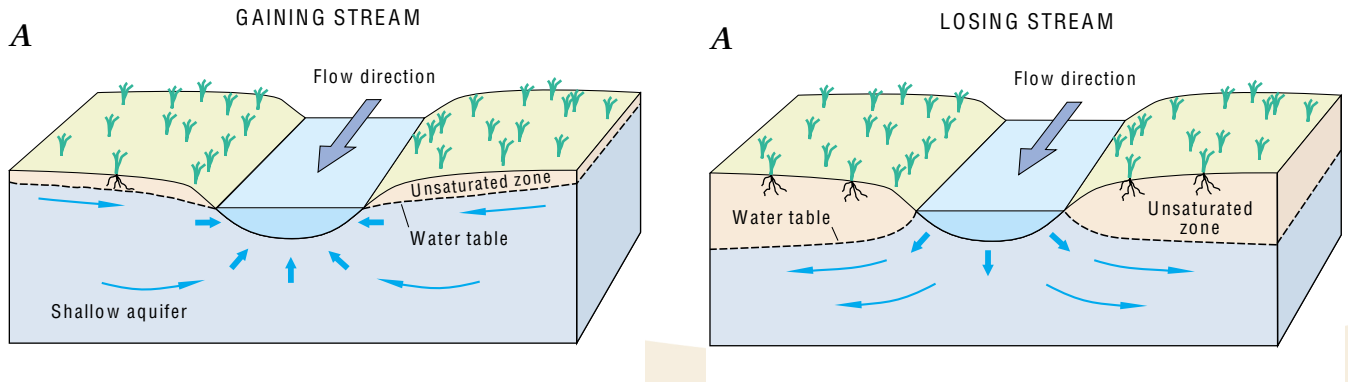
Understanding the connections between ground and surface water as part of the hydrologic cycle is crucial to successfully managing water resources.

Ground Water/Surface Water Interactions (GSI)

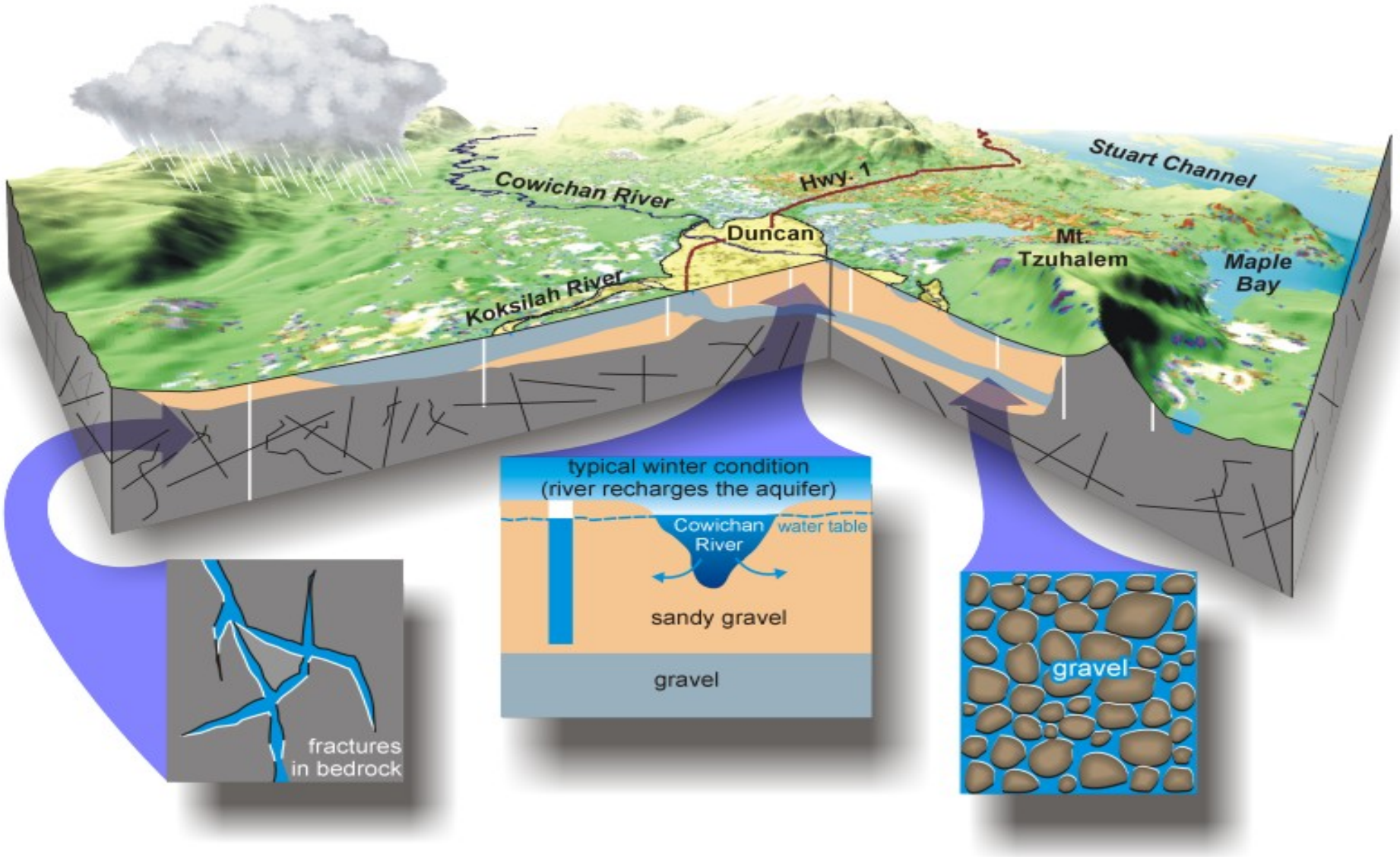
***It's ALL connected* -** exchange of water in and out of the stream bed and banks

Gaining stream: Stream that is being recharged by adjacent ground water

Losing stream: Stream that is recharging the ground water



Losing Stream

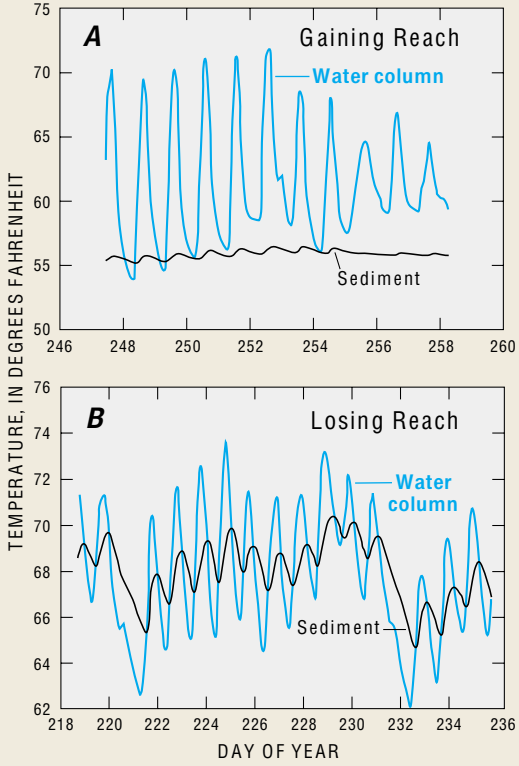


Ground Water/Surface Water Interactions (GSI)

Temperature of stream sediment a good measure for mapping gaining and losing reaches of streams

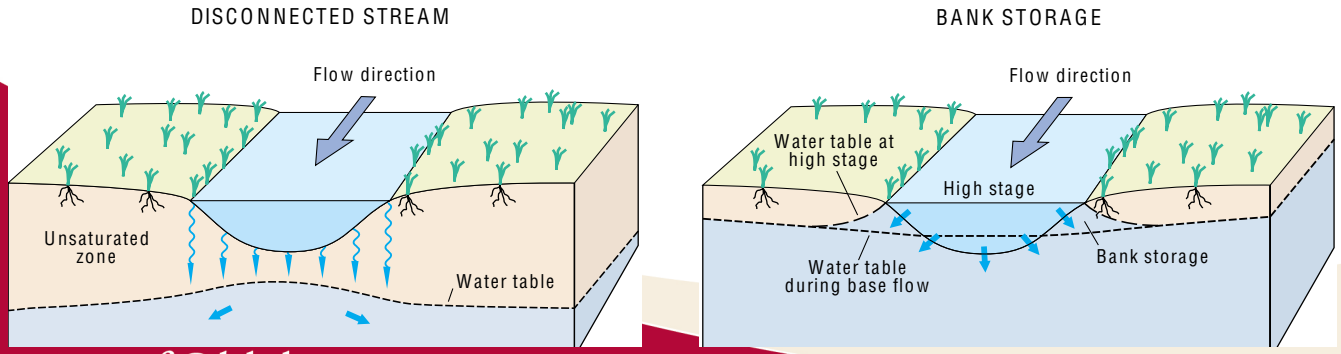
Gaining stream: Sediment temperature fairly constant

Losing stream: Sediment temperature varies widely and tracks water column temperature.



GSI

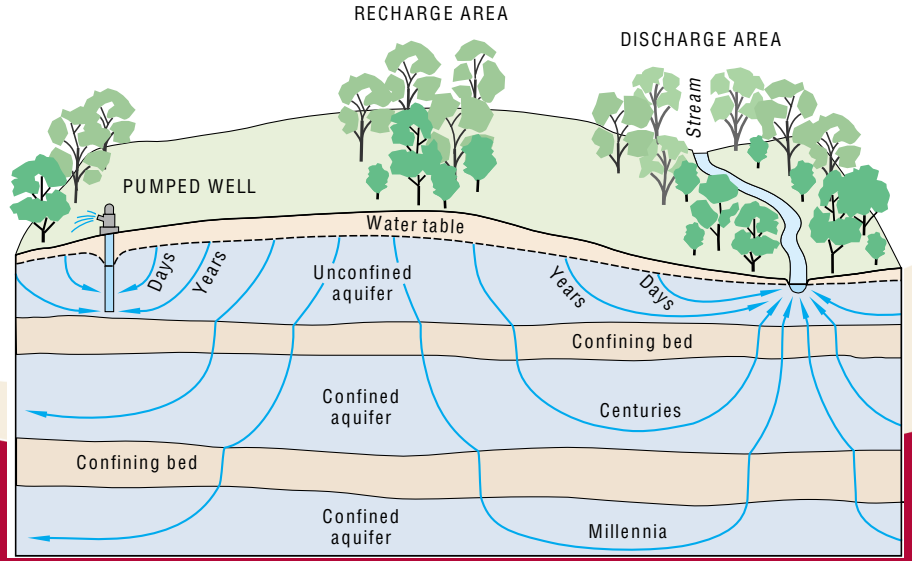
- ***Disconnected streams:*** Losing streams where no connection exists between stream and ground water
- ***Bank storage:*** rapid rise in stream stage that causes water to move from the stream into the streambanks; usually is caused by storm precipitation, rapid snowmelt, or release of water from a reservoir



GSI

GSI occurs at several temporal or spatial scales:

- Watershed scale GSI is on the order of miles and involves ground water discharge over an entire watershed which supplies the stream base flow.
- Near-stream scale GSI, on the order of feet and days, captures the losing/gaining reaches of streams that support aquatic and riparian habitats.

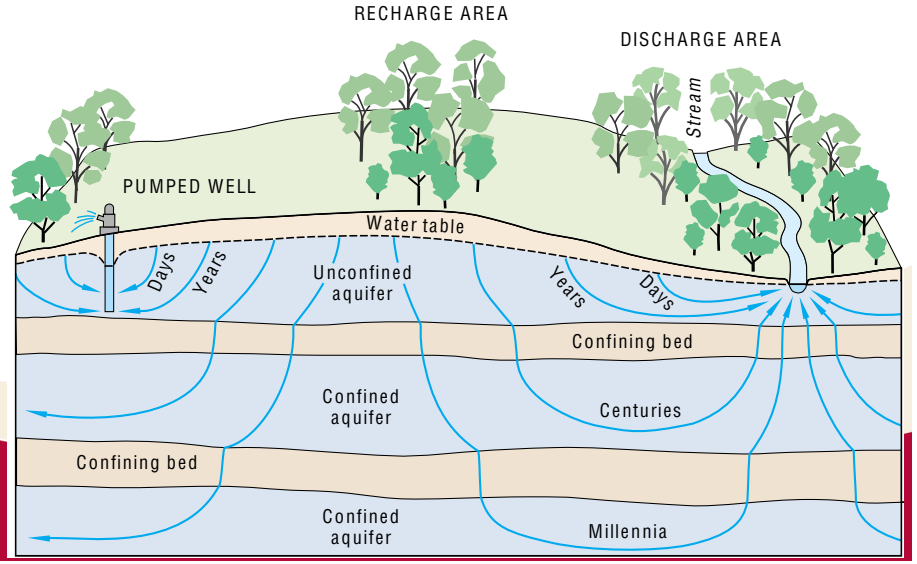


The University of Oklahoma

GSI

GSI greatly influenced by the presence of vegetation along streams, rivers, lakes:

- Buffer strips and riparian zones act to improve stream water quality through bank stabilization, reducing pollutant loading from overland flow and sediment loading
- These vegetation zones also support terrestial and aquatic habitats.

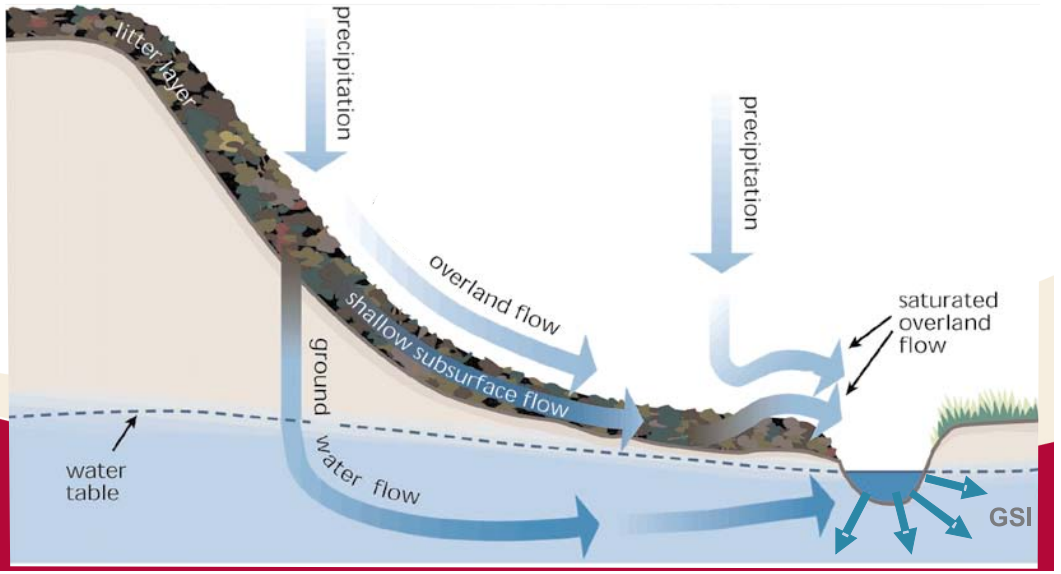


The University of Oklahoma

GSI

- Sediment scale GSI refers to exchanges in the stream beds and banks that occur on the scale of inches and minutes.

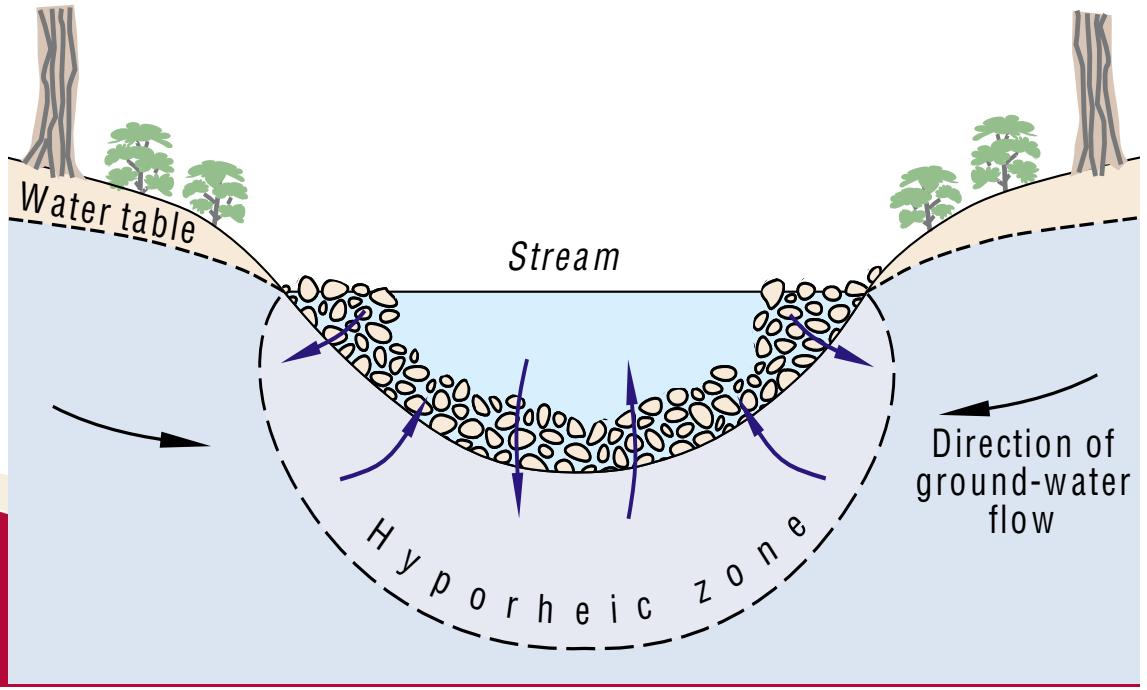
  GSI in the near-stream and sediment scale is often called hyporheic flow.



The University of Oklahoma

GSI

- The hyporheic zone is critical in support of aquatic life and important in terms of regulation of contaminant transport in subsurface systems.



The University of Oklahoma

GSI

- The extent of the hyporheic zone depends on the 3 dimensional character of the stream. This zone expands with meandering streams and varies with streambed slope changes as well.

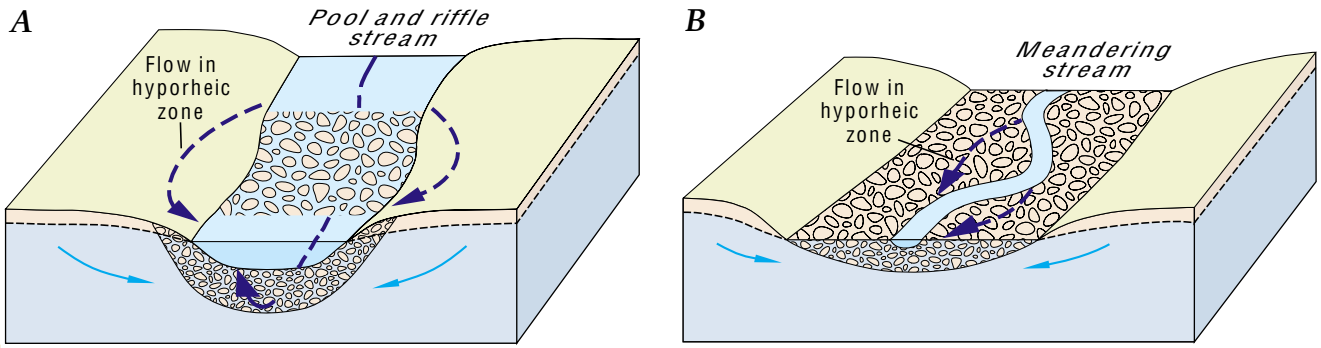
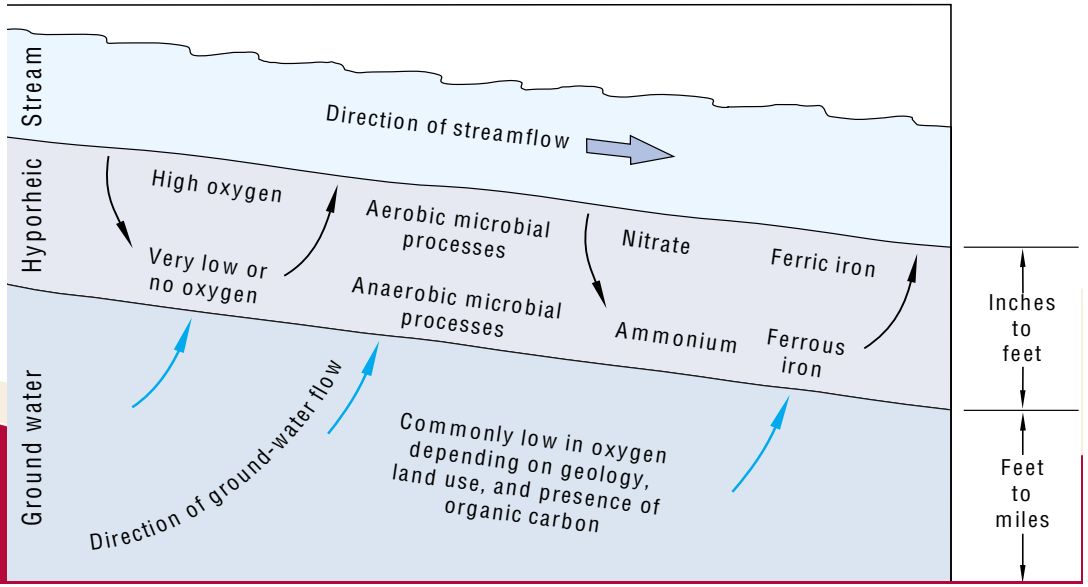


Figure 14. Surface-water exchange with ground water in the hyporheic zone is associated with abrupt changes in streambed slope (A) and with stream meanders (B).

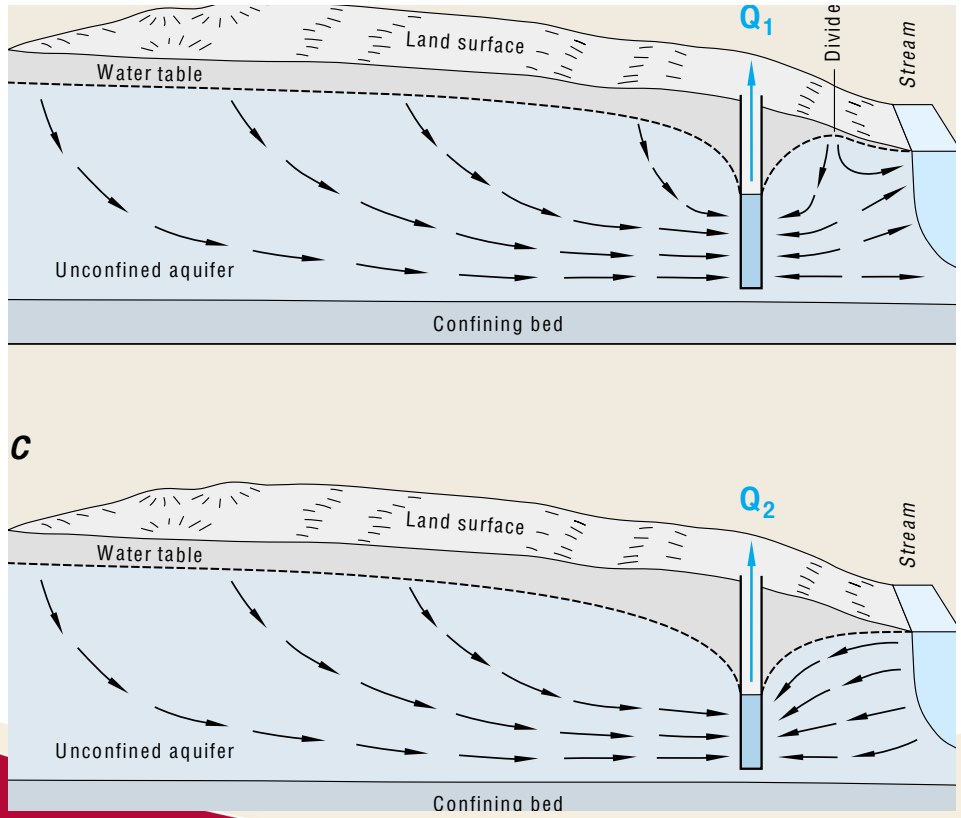
GSI

- The hyporheic zone is characterized by variations in oxygen levels, microbial processes and the speciation of inorganic compounds (e.g. N, Fe)
- This zone is an important source of nutrient uptake via microbial processes, and adsorption, precipitation reactions controlling inorganic-organic transport



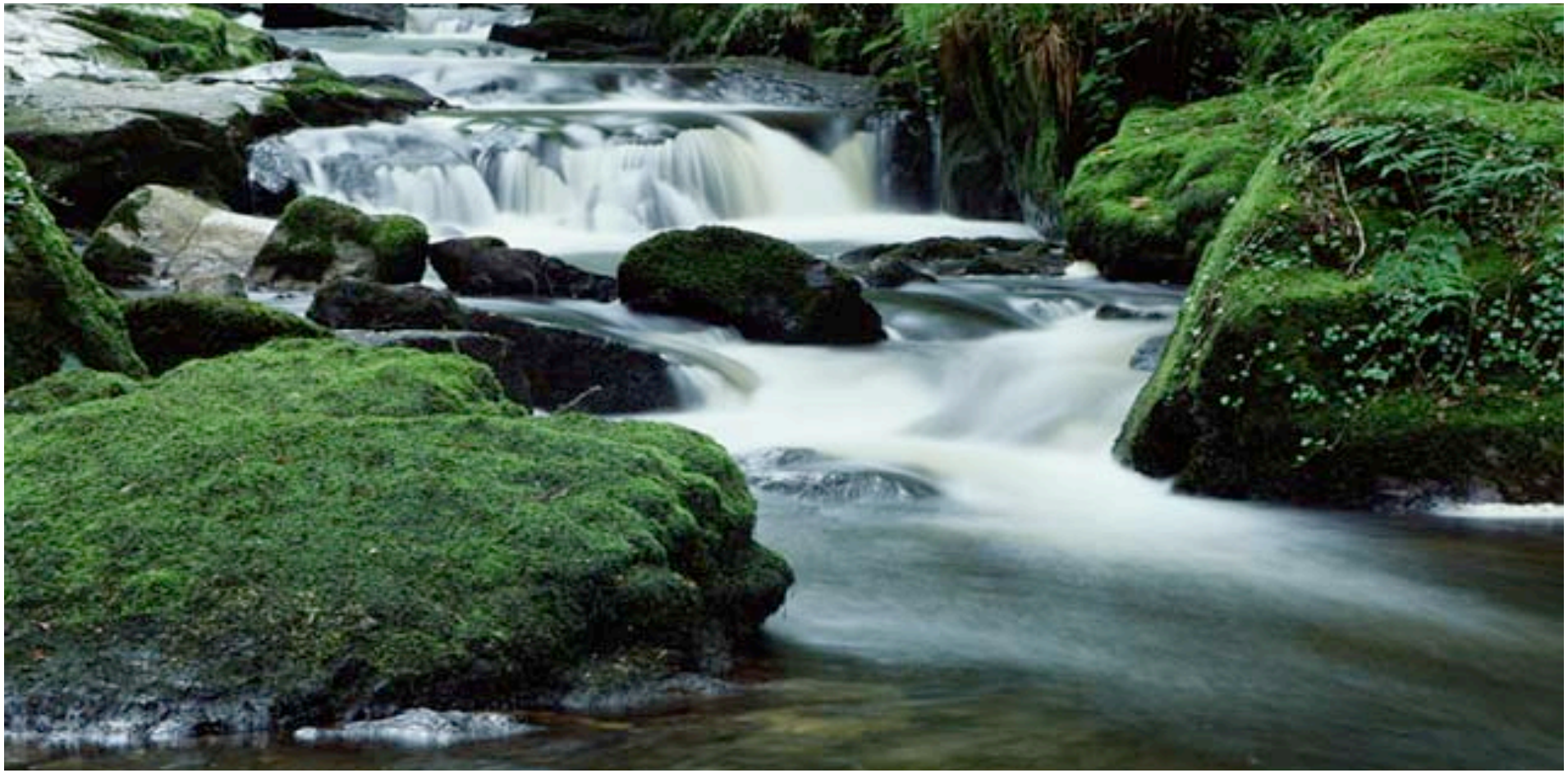
GSI and Pumping Wells

Wells can draw divert water discharging to adjoining streams and increased pumping can draw all water away from streams resulting in reduced flows and Negative impacts to aquatic Organisms.



Thank You for Your Attention

Acknowledgements: Graphics from USGS Circular 1139



Groundwater Recharge and Drought

Larry French, P.G.

Director, Groundwater Resources

Texas Water Development Board

May 10, 2012

Texas Water Development Board

Outline

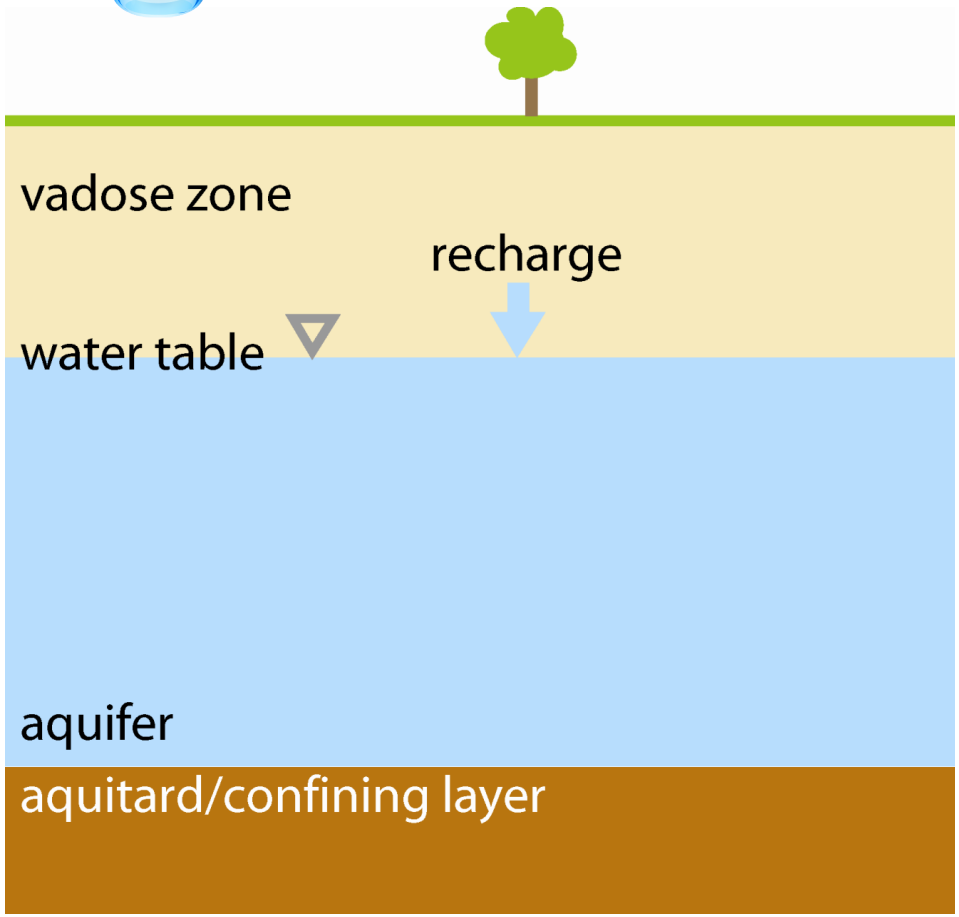
- Recharge: what is it? how is it measured?
- Recharge conditions: a tale of two aquifers
- Groundwater management and drought: know your aquifer

Texas Water Development Board

- **Recharge: what is it? how is it measured?**
- **Recharge conditions: a tale of two aquifers**
- **Groundwater management and drought: know your aquifer**

Texas Water Development Board

recharge



Recharge is water that infiltrates to the water table of an aquifer.

Texas Water Development Board

how is **recharge** measured?

- **Estimated is a better term than "measured."**
- **Diffuse or focused**
- **See next slide for:**
  - **Surface water**
  - **Unsaturated Zone**
  - **Saturated Zone**

Texas Water Development Board

Table 2. Suggested techniques for quantifying recharge to the major aquifers in Texas; E, Edwards aquifer; E-T, Edwards Trinity aquifer; CPA, Cenozoic Pecos Alluvium aquifer; GC, Gulf Coast aquifer; HMB, Hueco Mesilla Bolson; O, Ogallala aquifer; S, Seymour aquifer; and T, Trinity aquifer.

	E	E-T	CW	CPA	GC	HMB	O	S	T
Surface Water									
Channel water budget	✓		✓				✓		
Baseflow discharge		✓	✓						✓
Seepage meters							✓		
Heat tracers						✓	✓		
Watershed modeling	✓				✓				✓
Unsaturated Zone									
Zero Flux Plane	✓	✓	✓	✓	✓				
Tracers									
Cl			✓	✓	✓		✓		✓
^{36}Cl/Cl			✓	✓	✓	✓	✓		✓
^{3}H			✓	✓	✓	✓	✓	✓	✓
Modeling			✓	✓	✓	✓	✓	✓	✓
Saturated Zone									
Water table fluctuations			✓		✓			✓	✓
Tracers									
Cl			✓		✓	✓			✓
^{3}H		✓	✓	✓	✓	✓	✓	✓	✓
^{3}H/^{3}He			✓	✓	✓	✓	✓	✓	✓
CFCs		✓	✓		✓		✓		✓
^{14}C			✓			✓			✓
Modeling	✓		✓	✓	✓	✓	✓	✓	✓

Source:

"Groundwater Recharge in Texas" by Bridget Scanlon, Alan Dutton, Marios Sophocleous

Texas Water Development Board

- Recharge: what is it? how is it measured?
- Recharge conditions: a tale of two aquifers
- Groundwater management and drought: know your aquifer

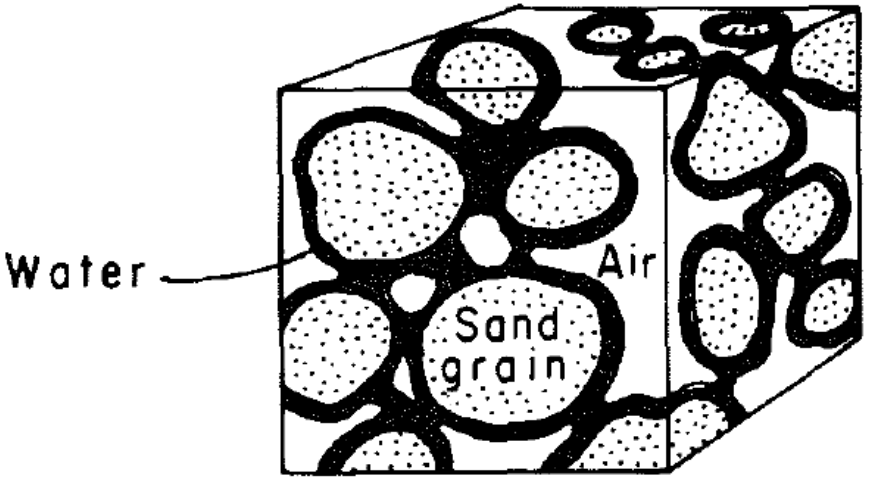
Texas Water Development Board

Recharge varies considerably

- High Plains/Ogallala aquifer: 0.004 to 1.7 in/yr (outside irrigated areas) and 0.5 to 8.6 in/yr (playa-focused)

- Edwards aquifer: dynamic, highly variable

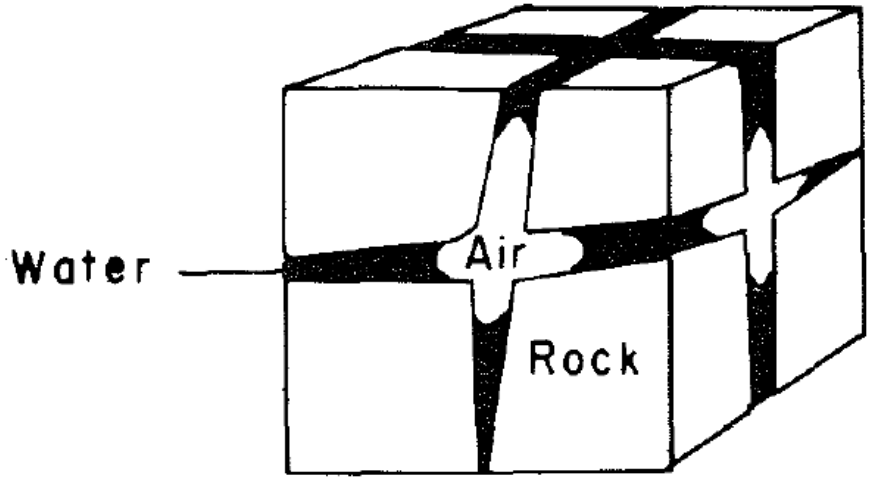
Texas Water Development Board



GRANULAR MATERIAL

Water retained as a film on rock surfaces and in capillary-size openings after gravity drainage.

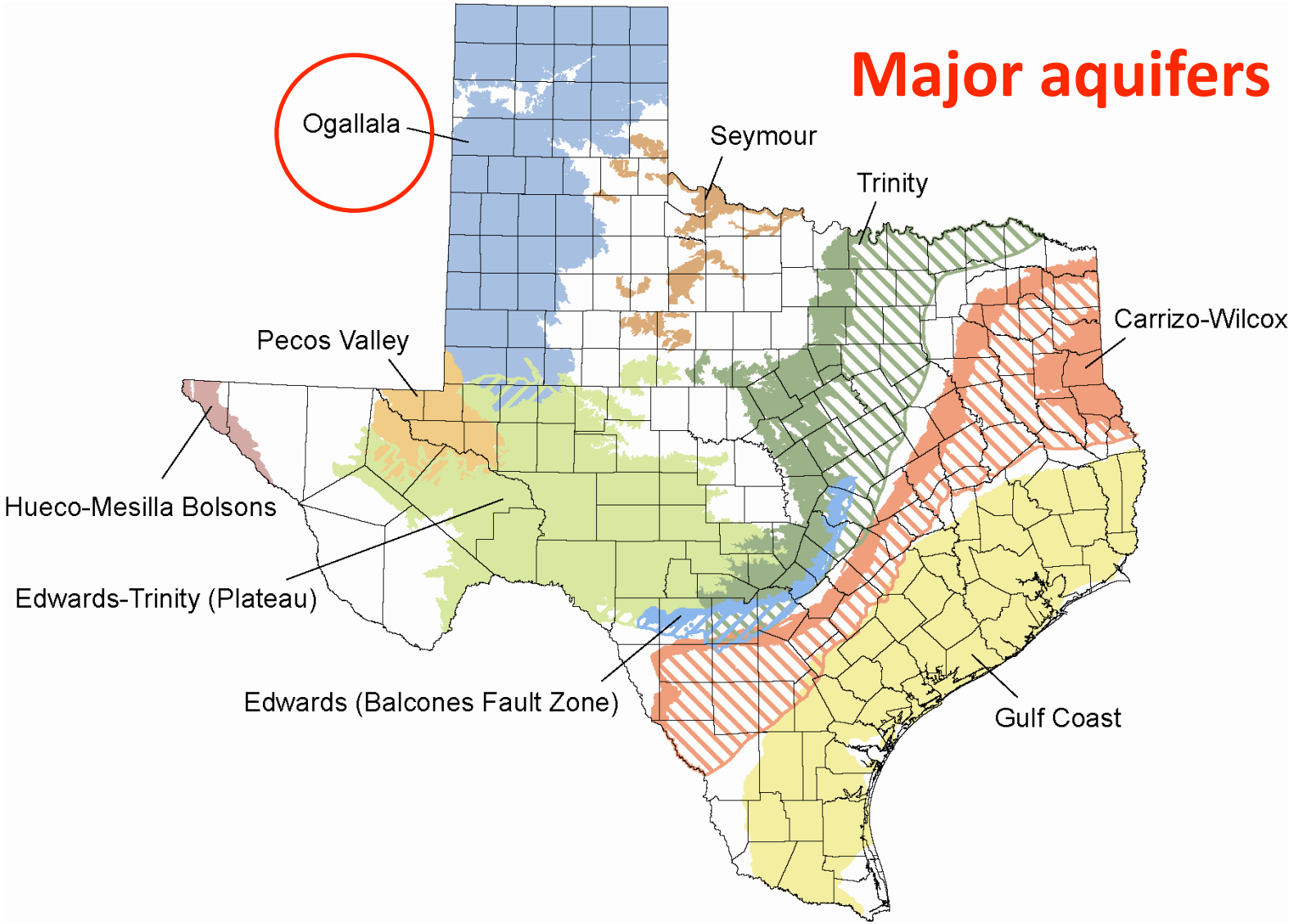
Heath, 1987



FRACTURED ROCK

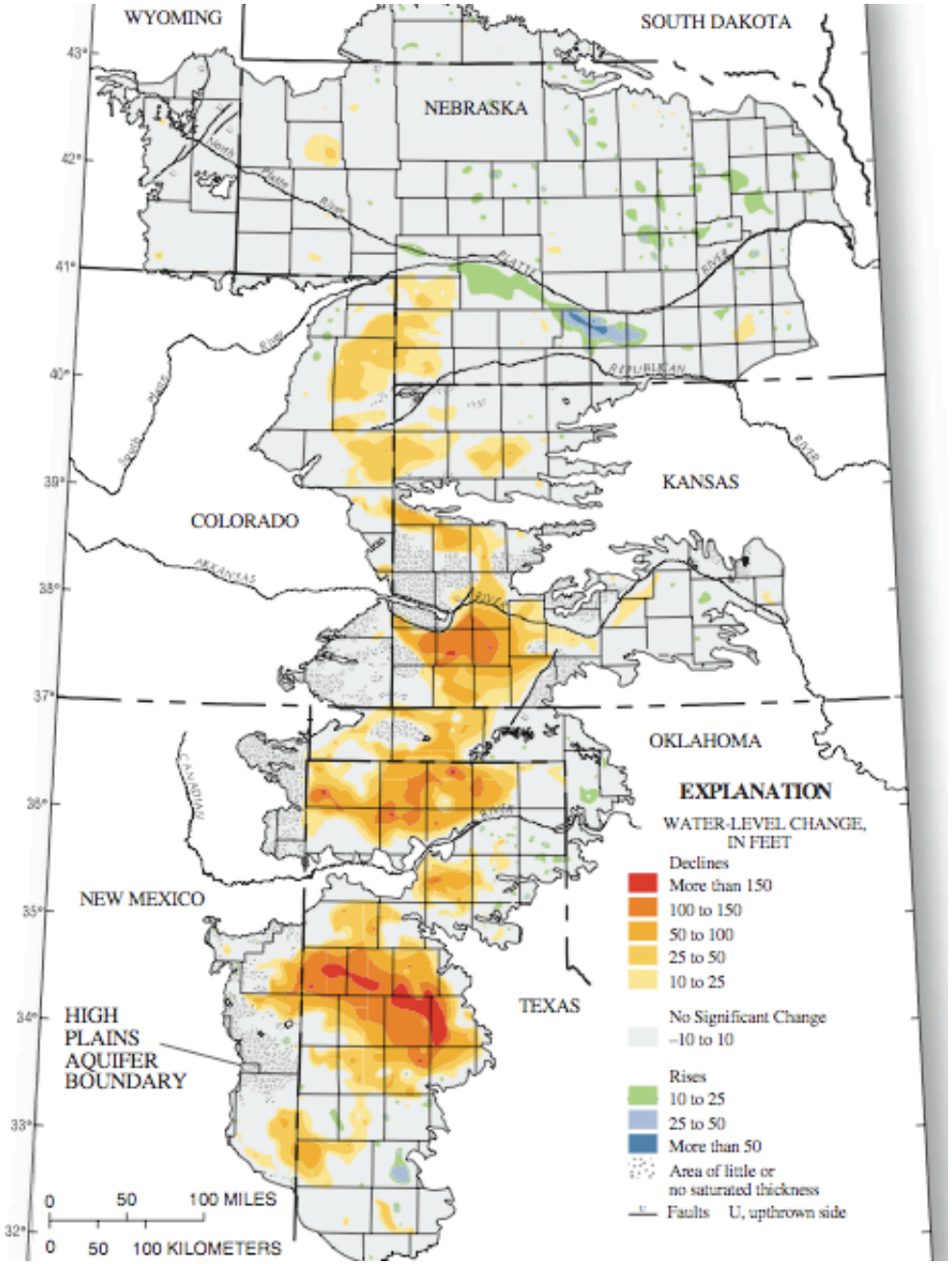
Texas Water Development Board

Major aquifers



Texas Water Development Board

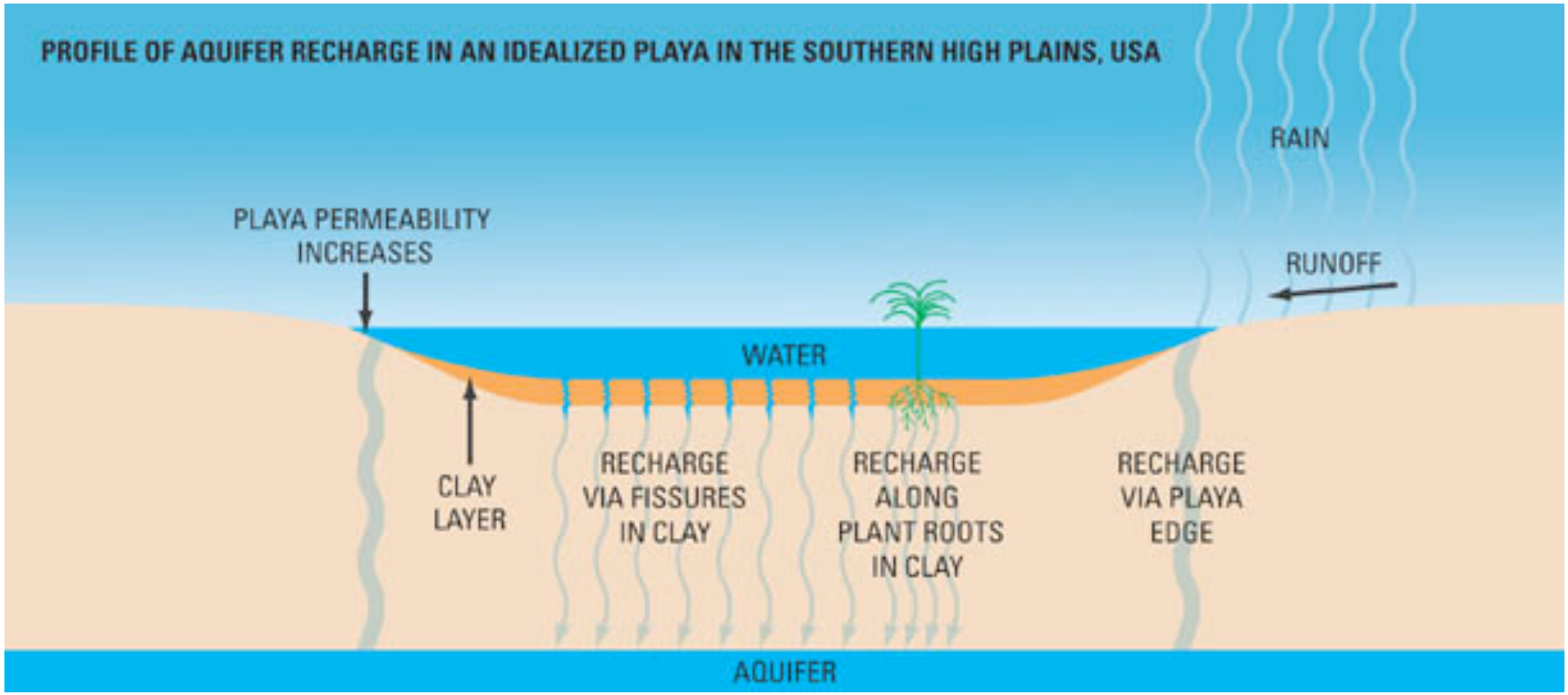
McDonald Irrigation Well, 1200 Gallons per Minute, Hereford, Texas.



Water level changes High Plains Aquifer

Scientific Investigations Report 2011-5089
USGS

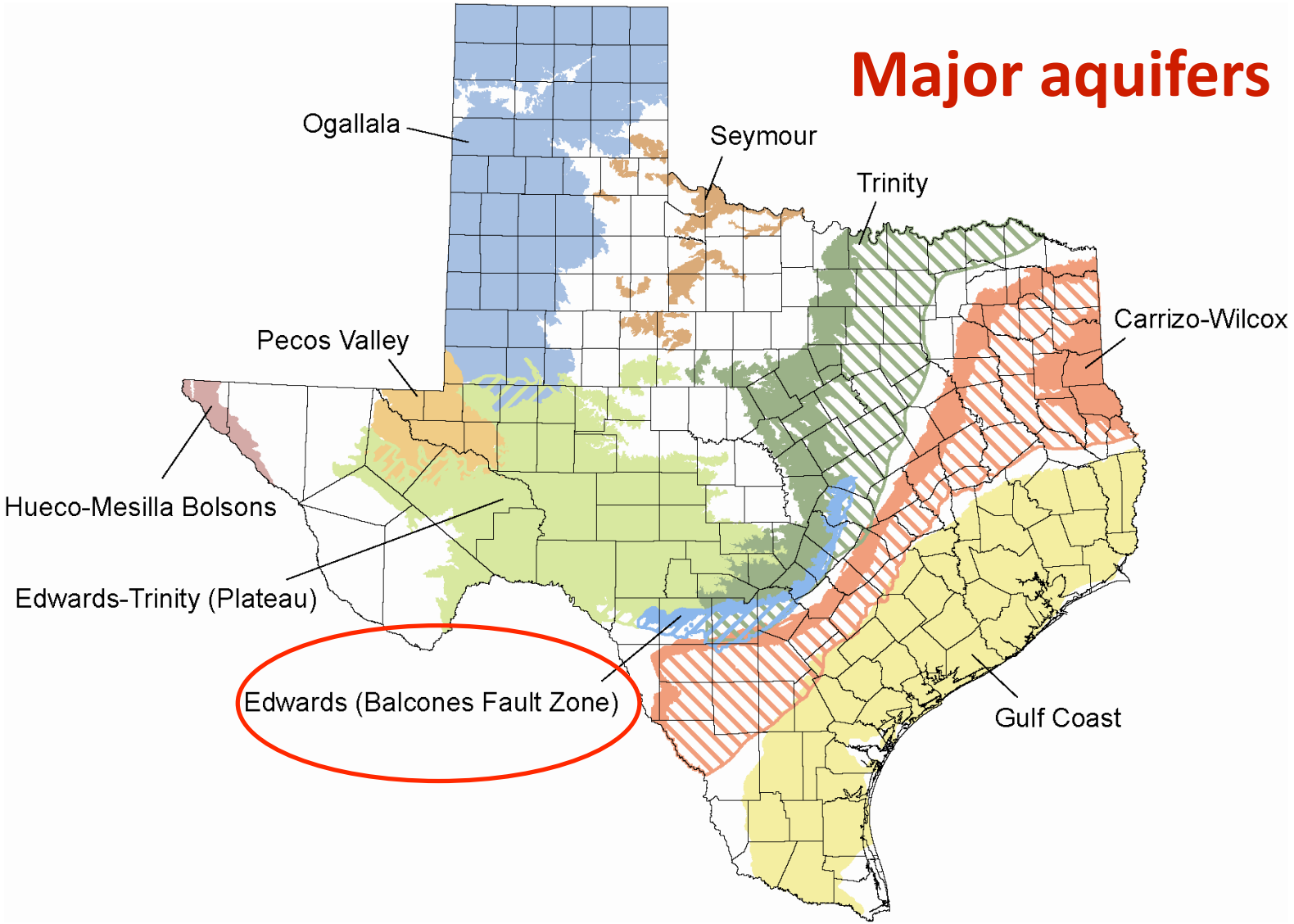
Texas Water Development Board



Graphic from Playa Lakes Joint Venture

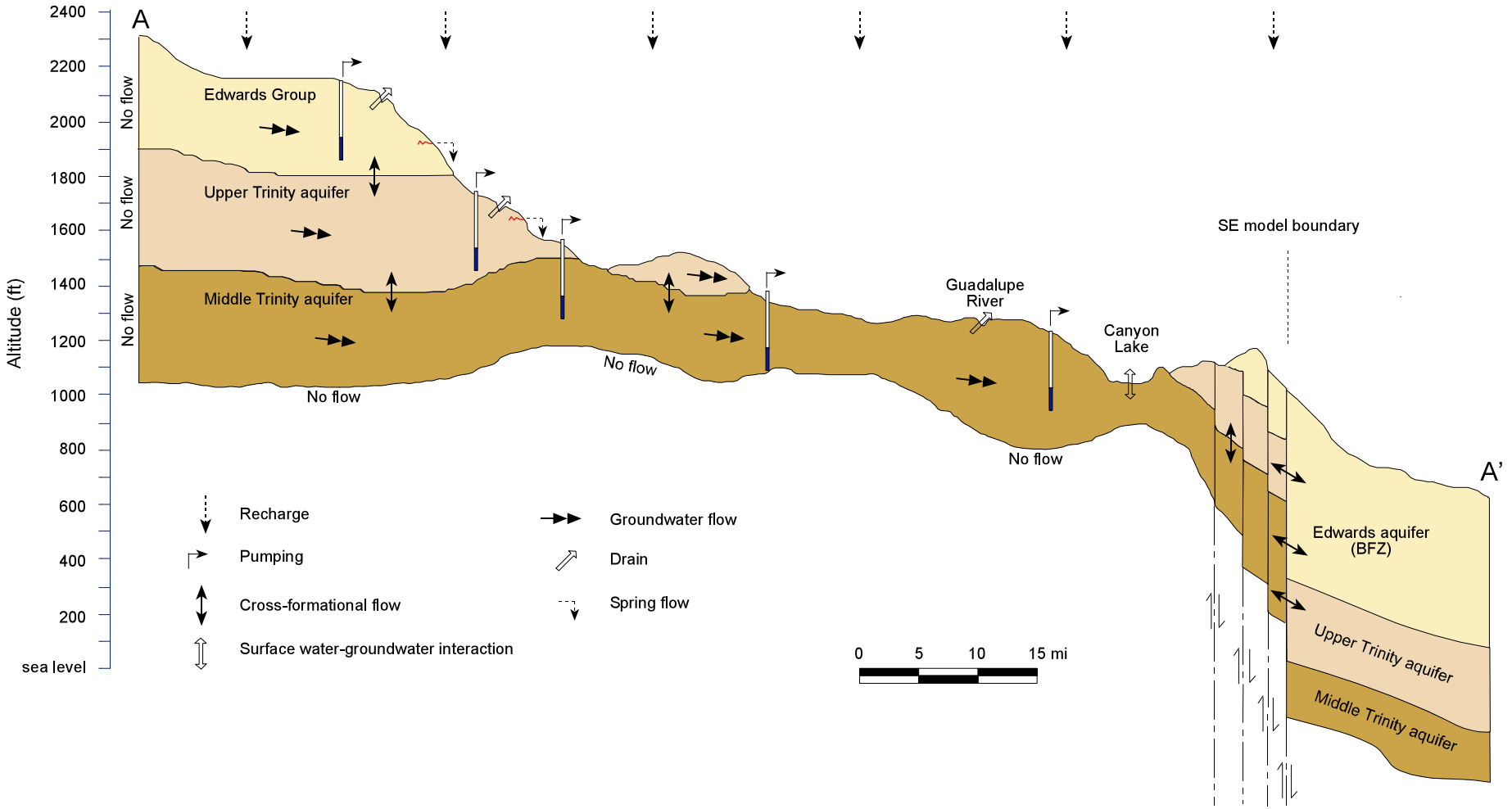
Texas Water Development Board

Major aquifers



Texas Water Development Board

cross-section - structure



Texas Water Development Board

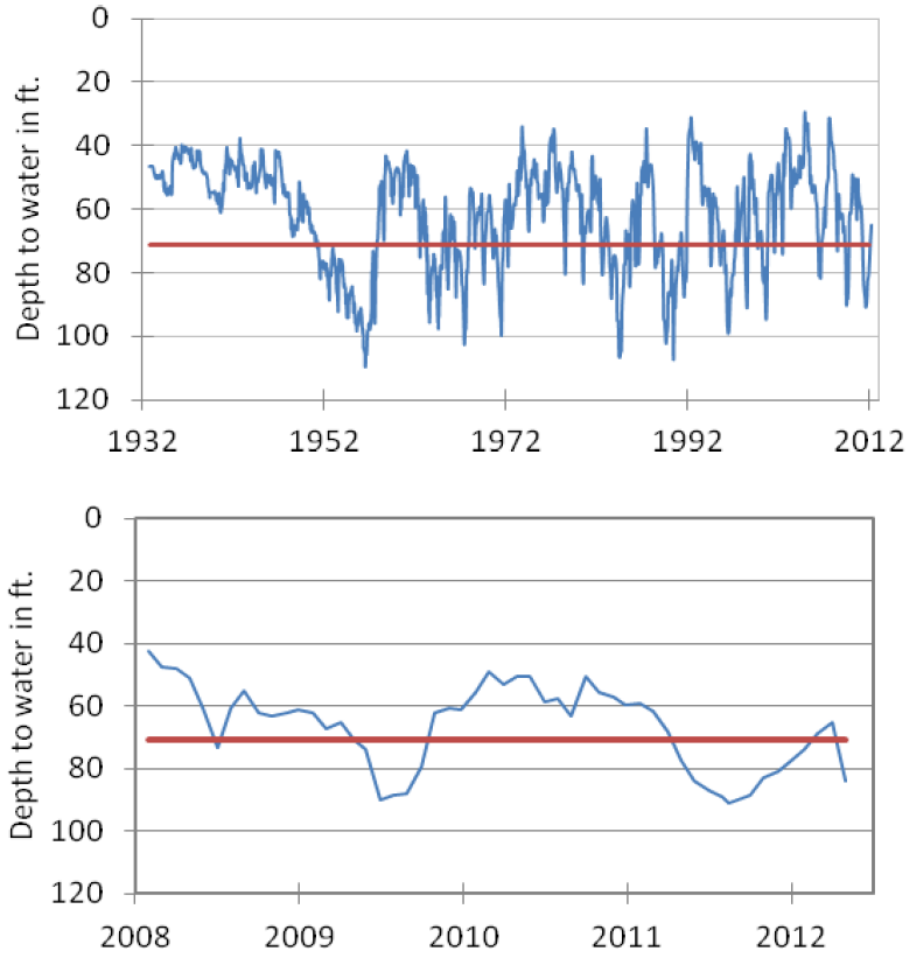
Texas Water
Development Board

July 2011 Groundwater Levels in Edwards Aquifer observation wells

- Declined in thirteen monitoring wells
- The J-17 well in San Antonio recorded a water level of 88.88 feet below land surface. This water level is 7.88 feet below the Stage II critical management level in that segment of the Edwards Aquifer. Stage II restrictions were triggered on June 1, 2011 by the Edwards Aquifer Authority after the 10 day average of water levels fell below 650 foot elevation or 81 feet below land surface.

Texas Water Development Board

(8) State Well ID 68-37-203 (J-17)
In San Antonio, Bexar County
Edwards (BFZ) Aquifer



The late April water level measurement in this Edwards (BFZ) Aquifer well, elevation 731 feet above sea level, was 84.08 feet below land surface. This was 19.09 feet below last month's measurement, 6.92 feet below last year's measurement, and 37.44 feet below the initial measurement recorded in 1932.

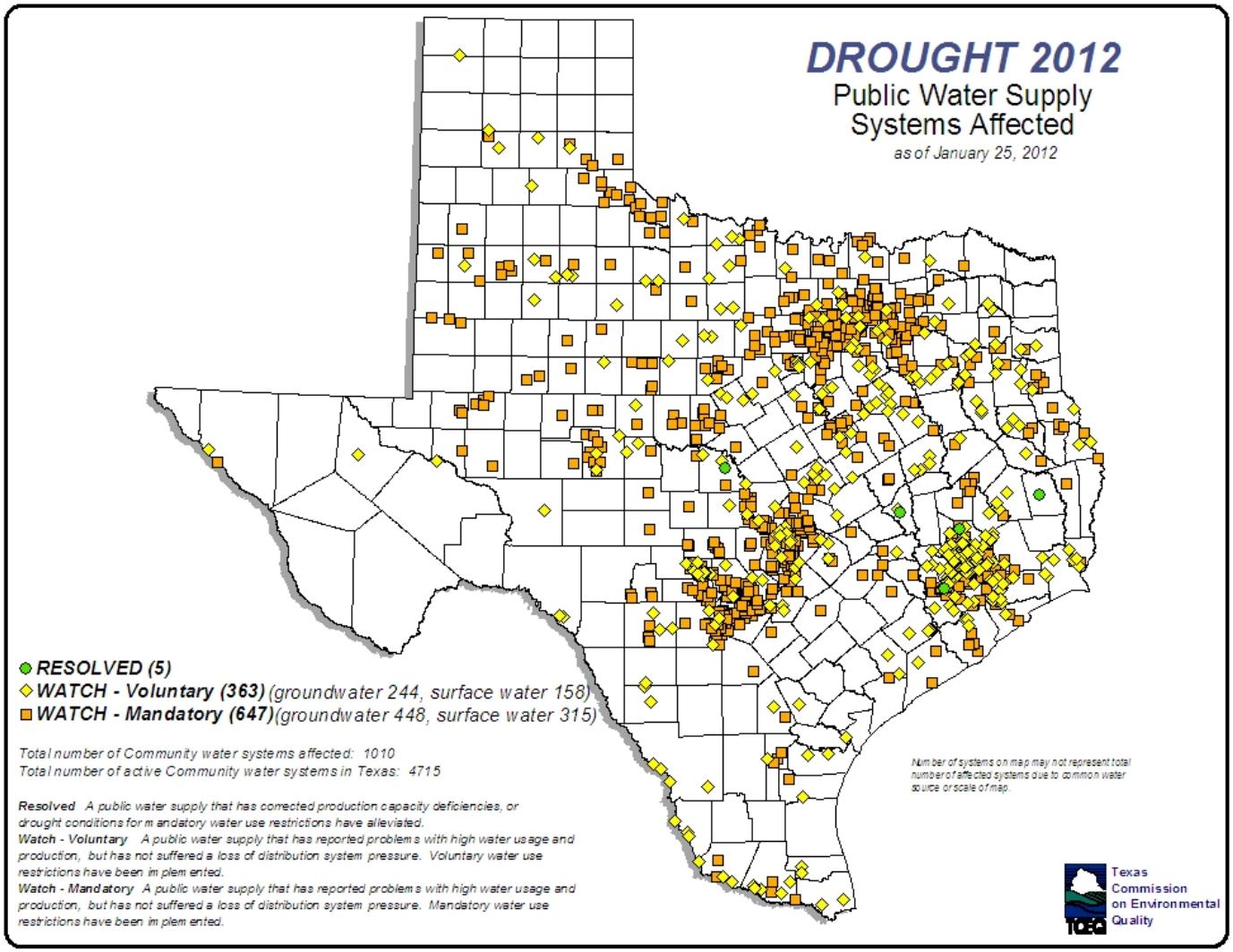
***** Water levels below the red line indicate Edwards Aquifer Authority Stage I drought restrictions. *****

Texas Water Development Board

- Recharge: what is it? how is it measured?
- Recharge conditions: a tale of two aquifers
- Groundwater management and drought: know your aquifer

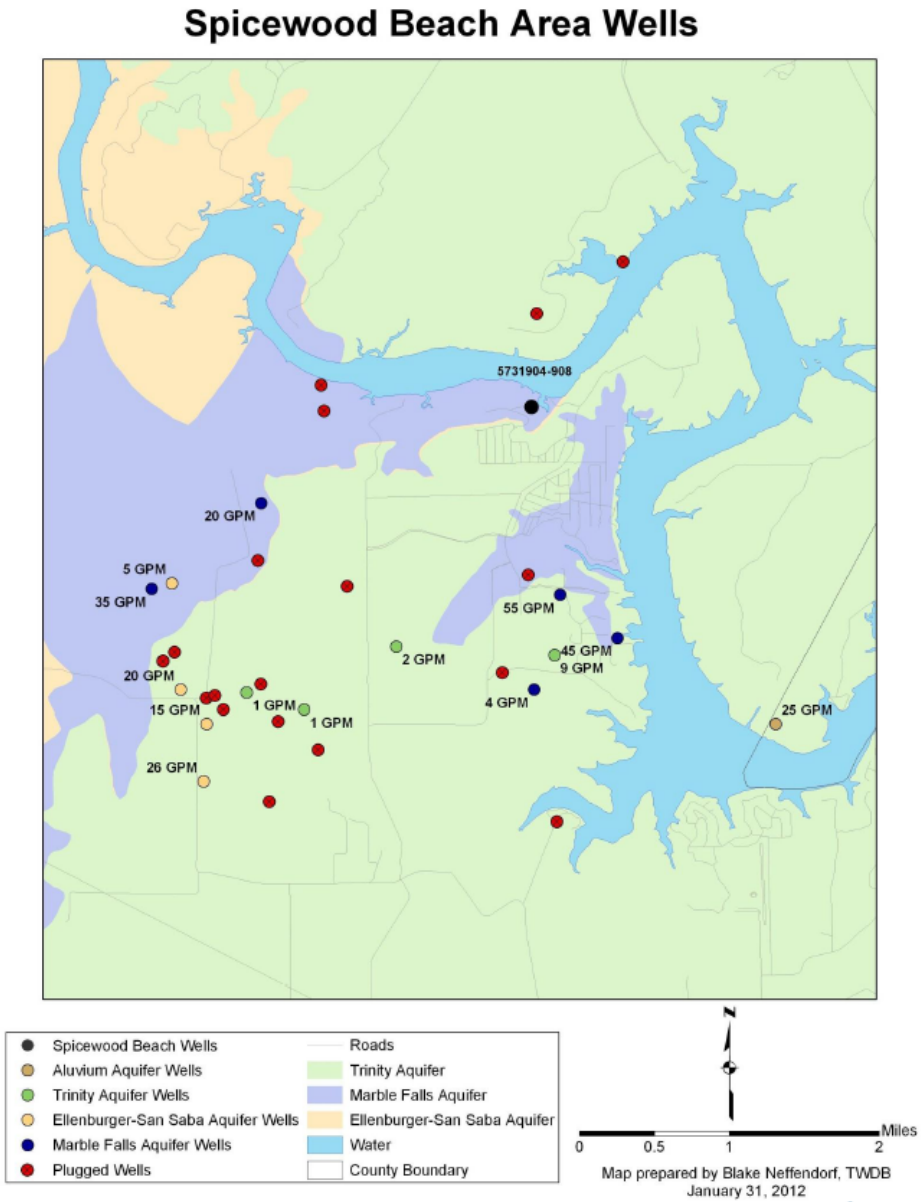
Texas Water Development Board

Public Water Supply Systems Affected by Drought



Spicewood Beach, near Austin

- Groundwater supply from shallow wells screened in Colorado River alluvium (normally inundated by Lake Travis).
- Lake Travis water level declined significantly in drought of 2011.
- By early 2012, groundwater levels in alluvium had also decreased to the point that the water supply wells were dry.



Texas Water Development Board

Declining groundwater levels can affect surface water resources

TWDB has evaluated several factors that have played a role in the decline in Lake Meredith storage. Reductions in:

- Releases from Ute Dam (upstream in New Mexico) - ~ 32%
- Irrigation from return flows from Revuelto Creek (downstream of Ute Dam) - ~23%
- Base flow due to declining groundwater levels - ~ 22%
- Runoff from precipitation - ~ 18%
- Other factors - ~5%

These are estimates based on comparison of conditions for 1965-2000 and 2001-2006.

Texas Water Development Board

Contact Information

Larry French, P.G.

Director, Groundwater Resources

Texas Water Development Board

larry.french@twdb.texas.gov

512-463-5067

www.twdb.texas.gov

ABRFC Experimental Soil Moisture Graphics

Eric Jones/Lee Crowley
Arkansas/Red River Forecast Center
National Weather Service
Tulsa, OK, USA

Soil Moisture Computation

- Uses the SACSMA continuous soil moisture operation of the 4x4 km OHD distributed hydrologic model
- 17 model parameters
- Model parameters based on soil type/land use.
- Climatological PE used

Soil Moisture Computation (continued)

- Uses hourly QPE rainfall from radar/gage computations
- Model run in a hourly time step.
- Upper layer computed from upper zone tension and free water values
- Lower layer from lower zone tension, primary and supplementary values.

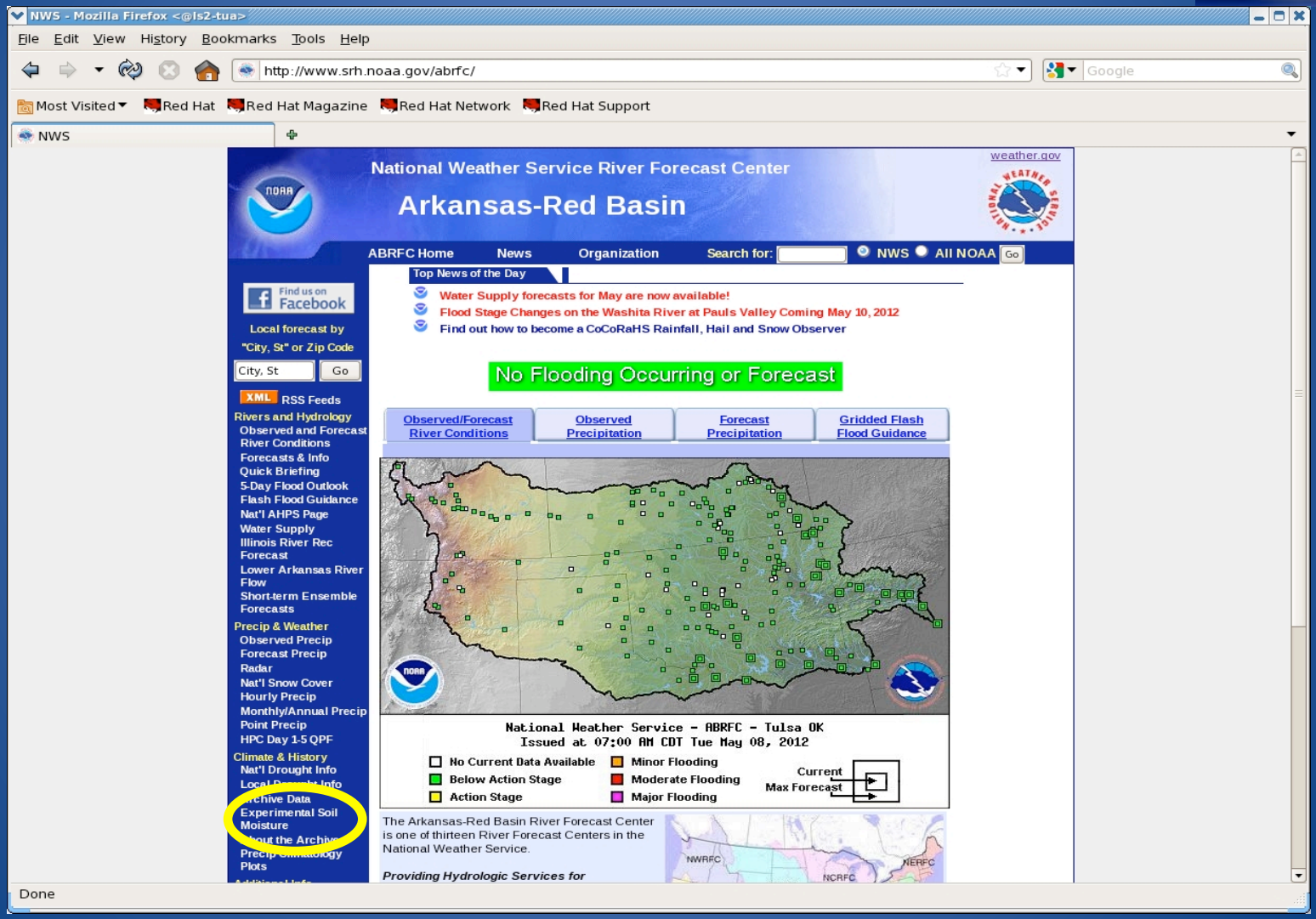
Soil Moisture Computation (continued)

- Hopefully more useful than total soil moisture as it is broken up into upper/ lower soil moisture.
- Upper zones more useful for agricultural use
- Lower zone useful for hydrologic/ground water use

Soil Moisture Graphic Computation

- Climate monthly statistics uses 16 years of model data from 1996-2011.
- Graphics produced daily around noon.
- Produced via the NWS Community Hydrologic Prediction System (CHPS)

Main page

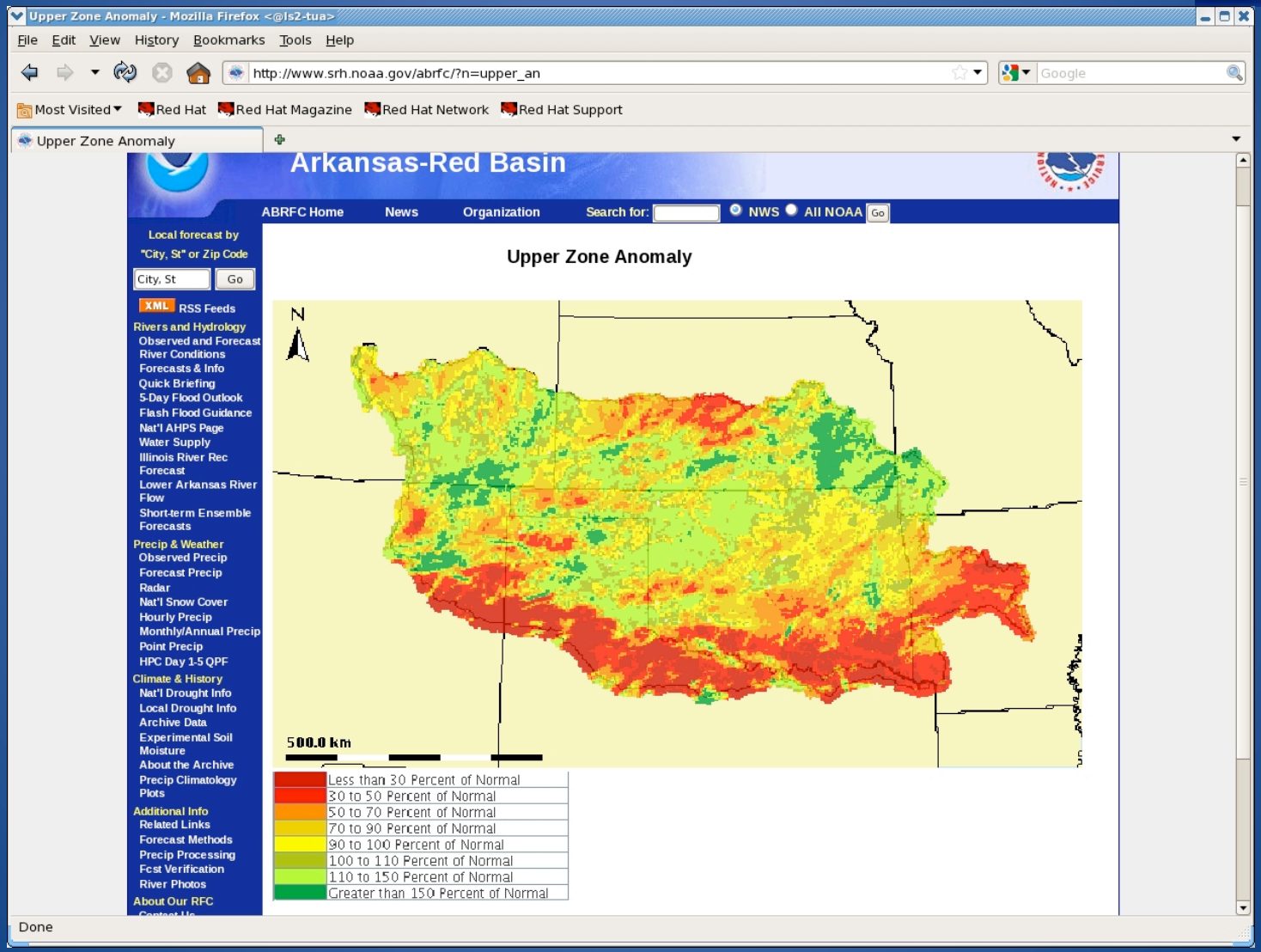


http://www.srh.noaa.gov/abrfc

Upper Zone Anomaly

- Sensitive to short term rainfall.
- Can change drastically from day to day, especially during large rainfall events.
- Representative of the first few inches of soil.

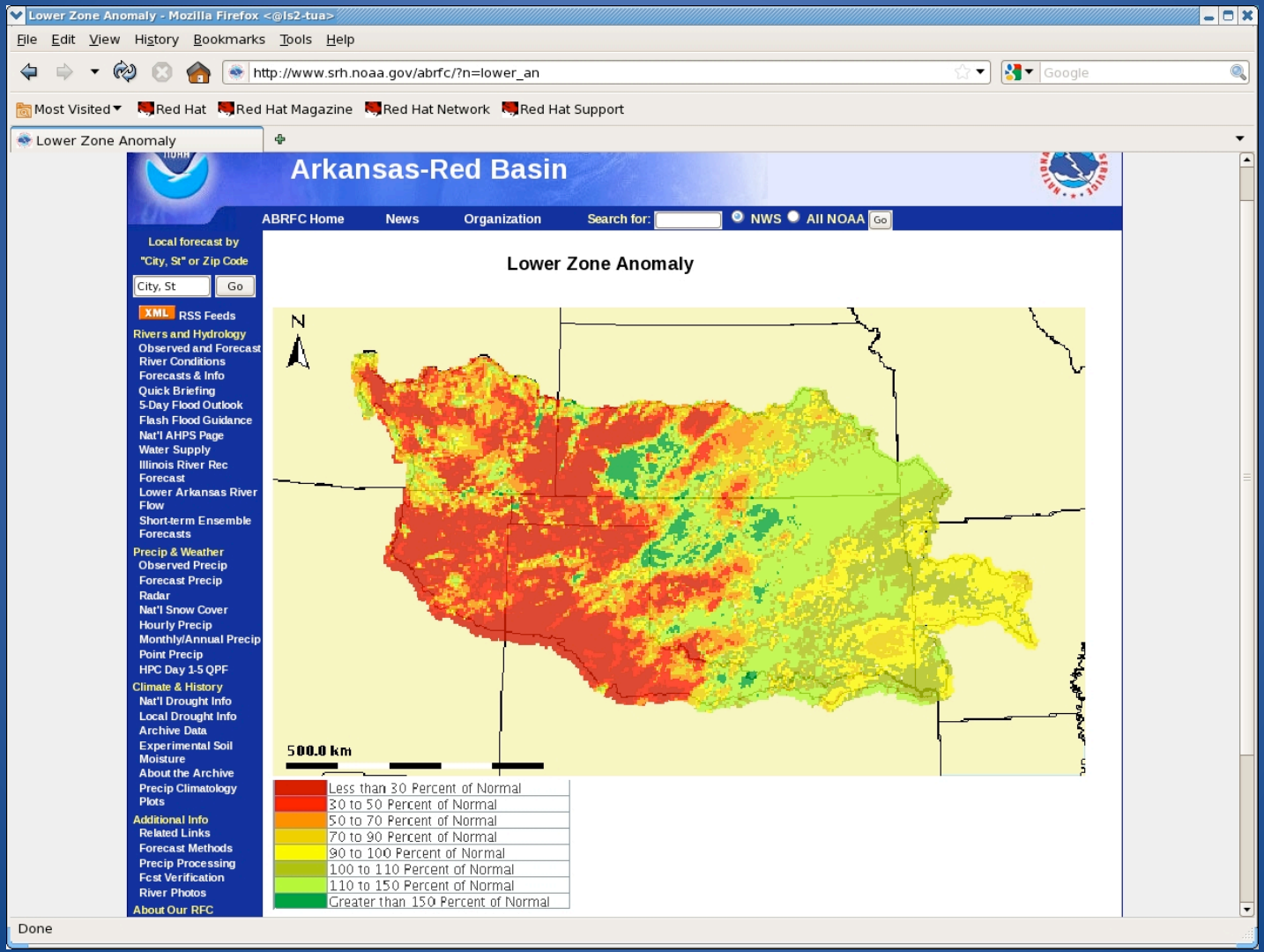
Upper Zone Anomaly



Lower Zone Anomaly

- Changes very slowly over time.
- Not extremely sensitive to rainfall events.
- Takes multiple rainfall events to drastically change values.
- Extends several feet down the soil column.

Lower Zone Anomaly



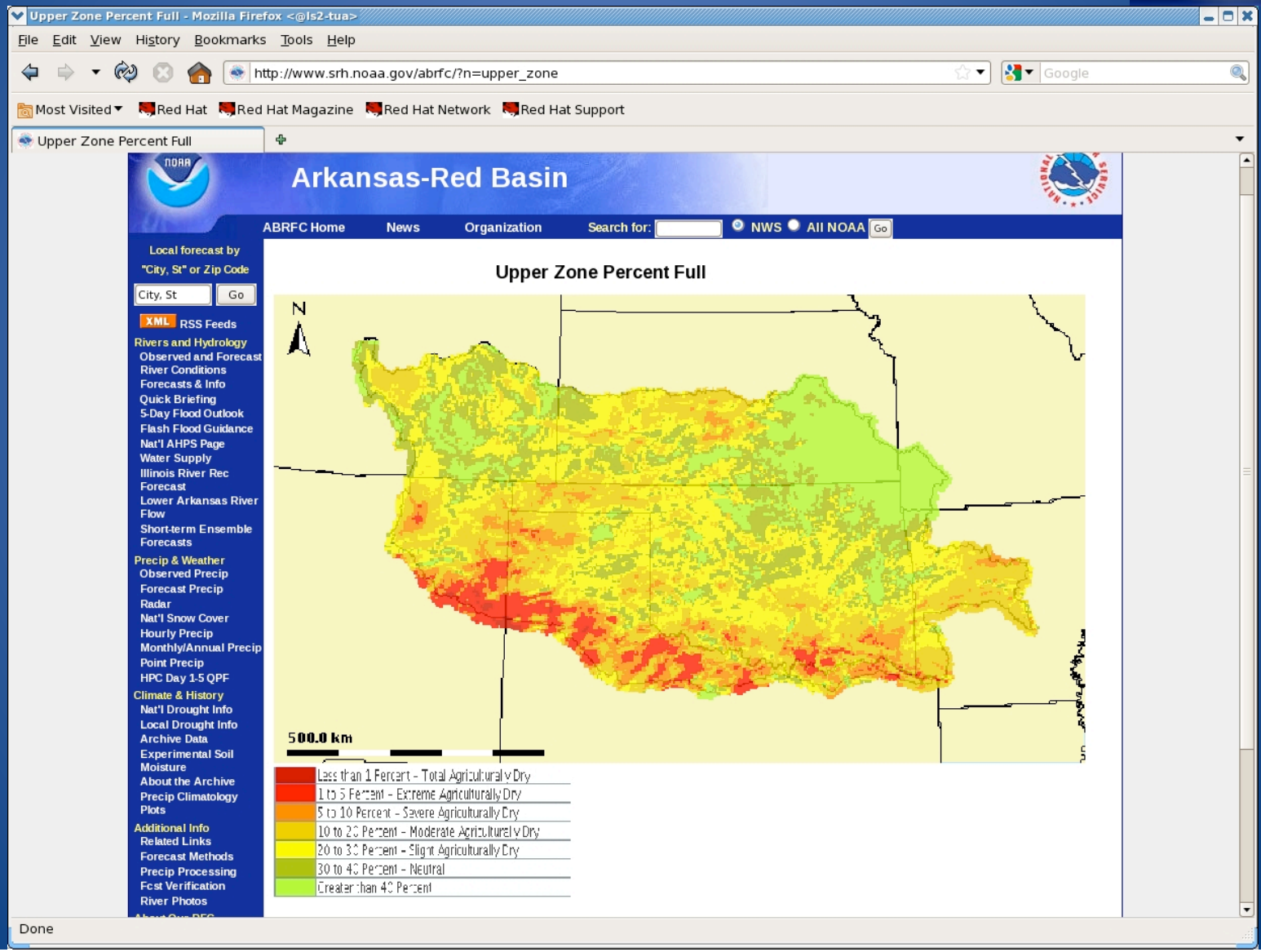
Anomaly notes

- Anomaly values more sensitive across climatologically dry areas.
- Any inputs on scale?

Upper Zone Moisture Values

- Percent fullness of 2 upper zone model parameter contents versus parameter maximums.
- Input needed on scale of legend/ categorical values

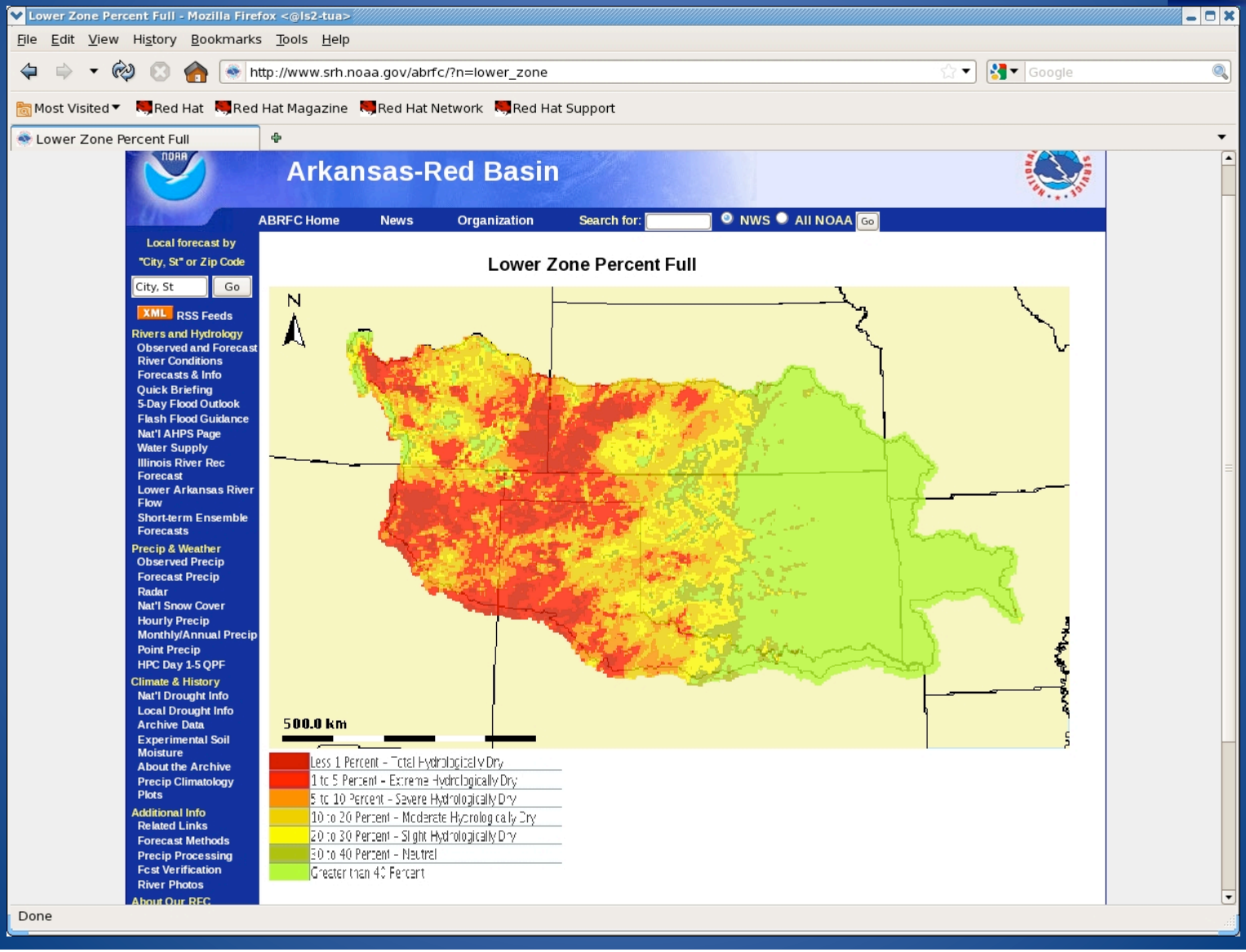
Upper Zone Moisture Values



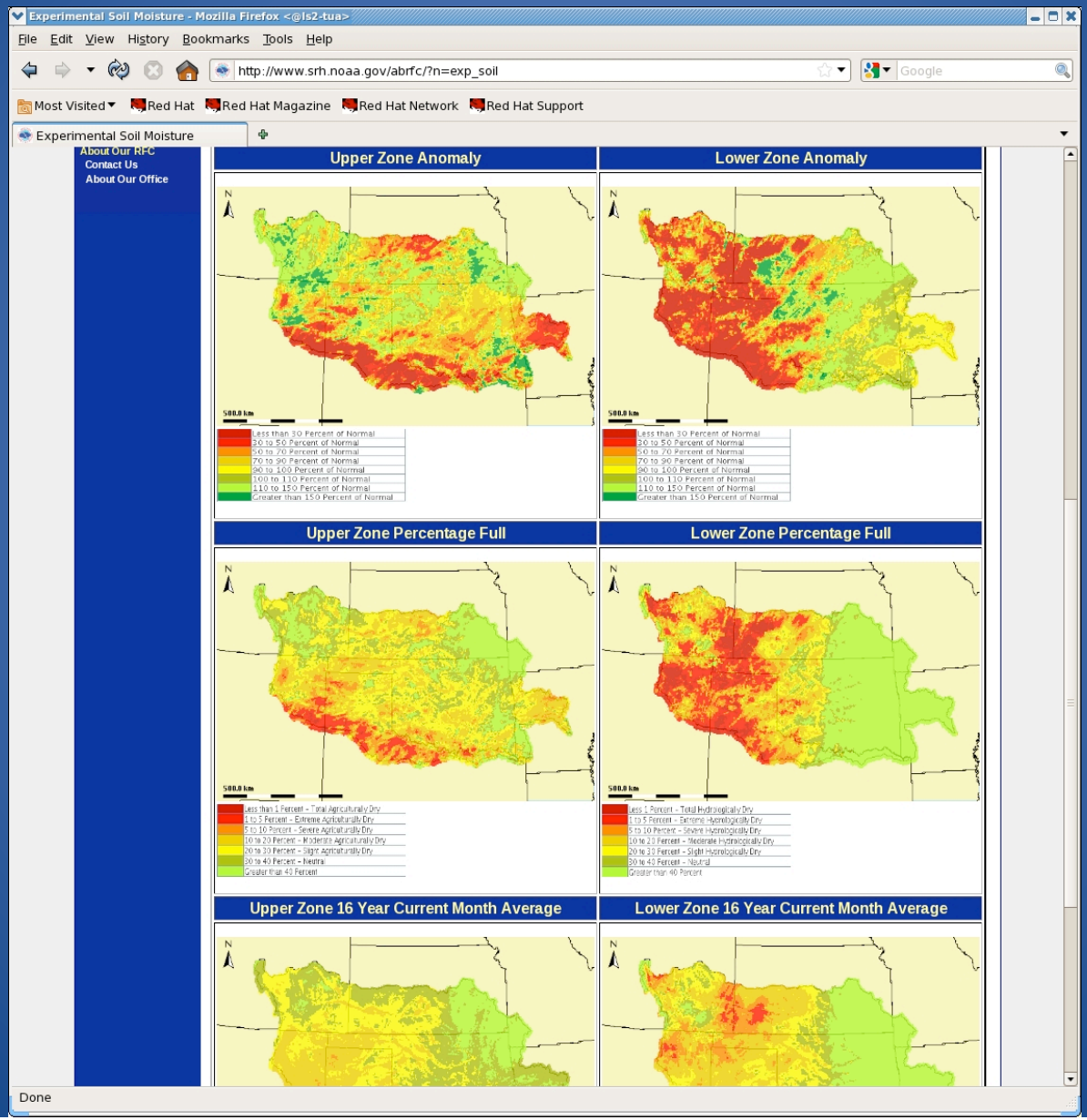
Lower Zone Moisture Values

- Percent fullness of 3 lower zone model parameter contents versus parameter maximums.
- Input needed on scale of legend/ categorical values

Lower Zone Moisture Values



Webpage


Experimental Soil Moisture - Mozilla Firefox <@ls2-tua>
File Edit View History Bookmarks Tools Help
http://www.srh.noaa.gov/abrfc/?n=exp_soil
Most Visited Red Hat Red Hat Magazine Red Hat Network Red Hat Support
Experimental Soil Moisture
About Our RFC
Contact Us
About Our Office
Upper Zone Anomaly
Lower Zone Anomaly
Upper Zone Percentage Full
Lower Zone Percentage Full
Upper Zone 16 Year Current Month Average
Lower Zone 16 Year Current Month Average
Done

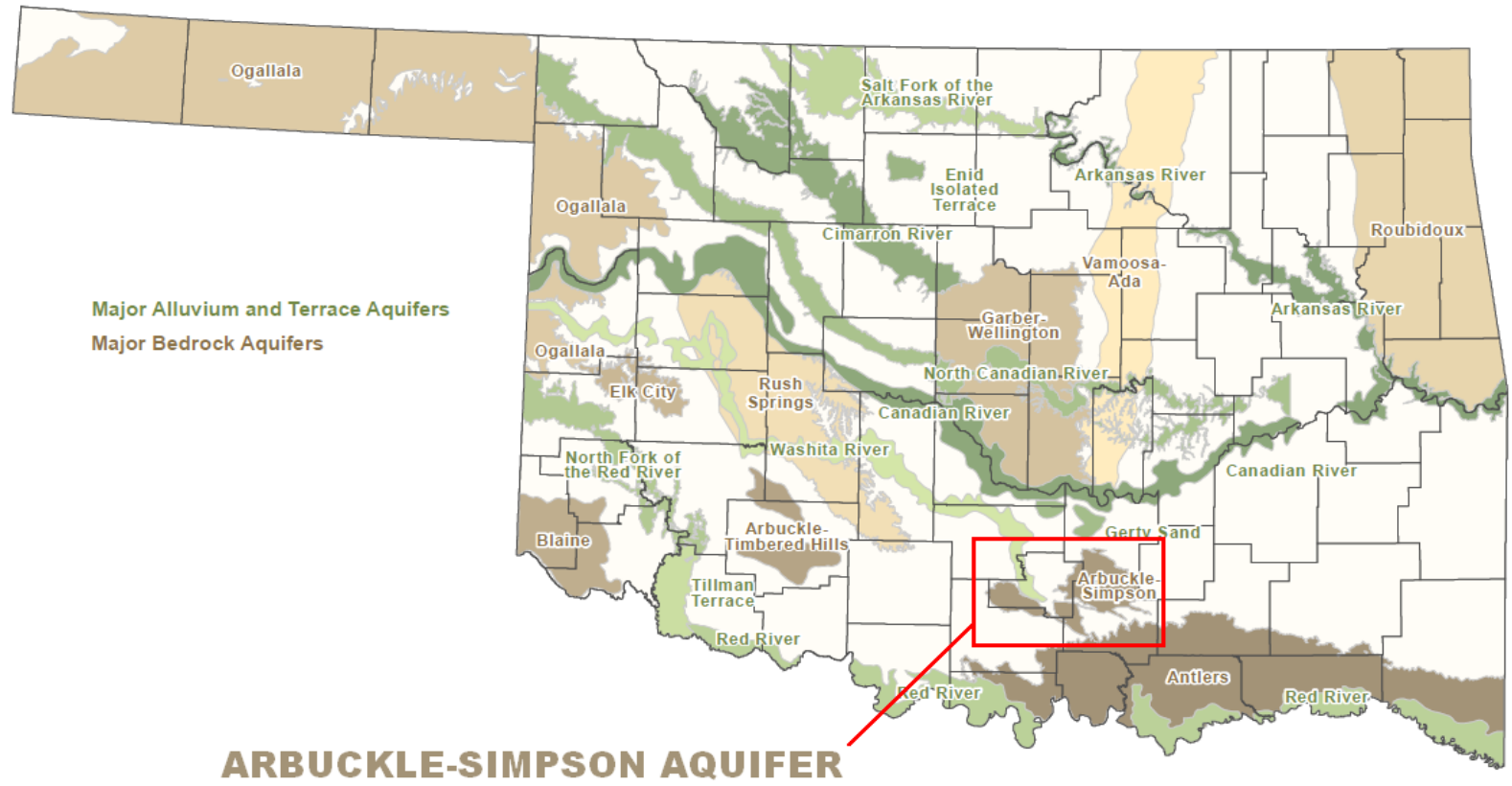
QUESTIONS?



Arbuckle Simpson Aquifer

Daune Smith, Choctaw & Chickasaw Nations


Major Groundwater Aquifers of Oklahoma

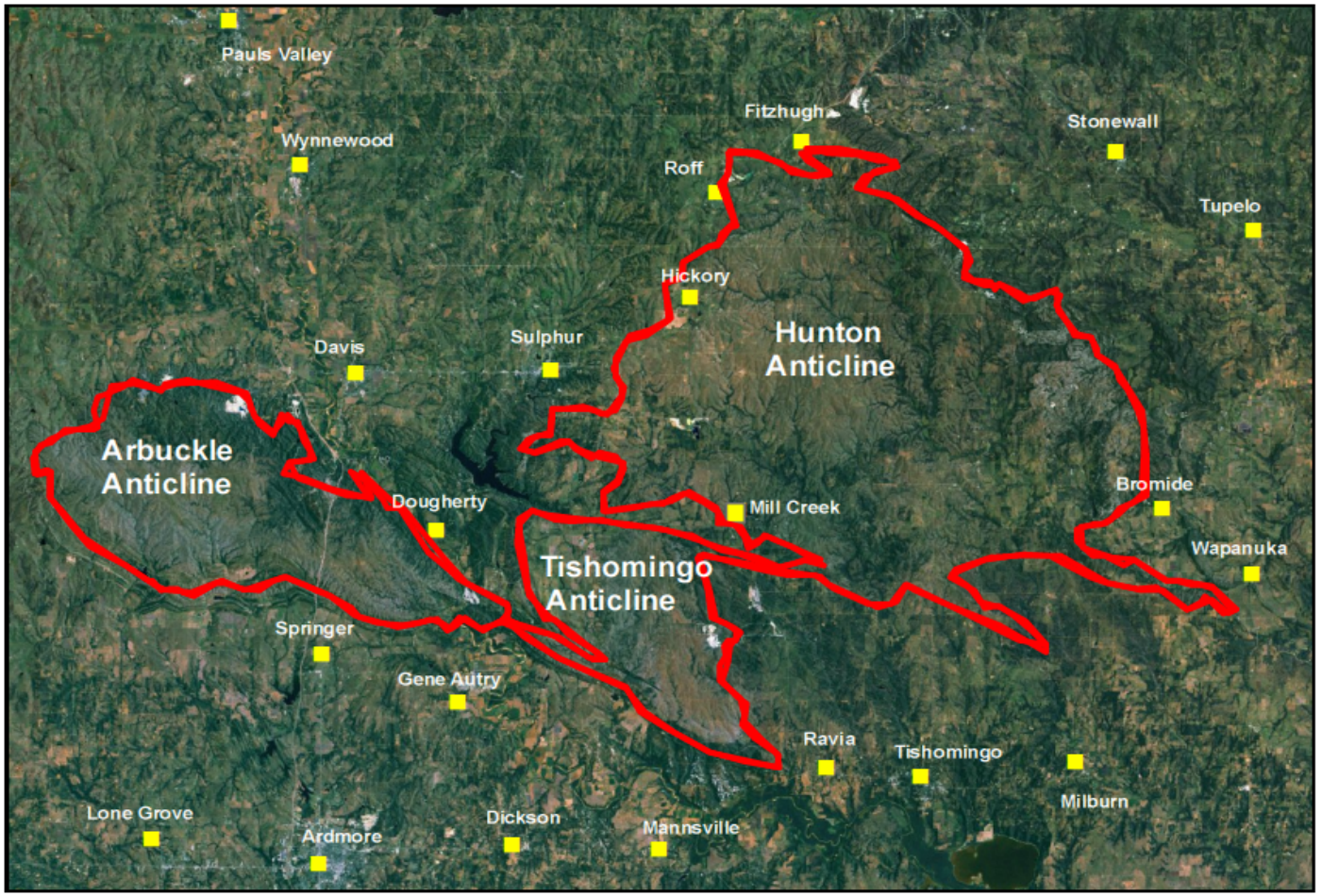


State of Oklahoma
OWRB
Water Resources Board
the water agency

The Arbuckle Simpson Aquifer is the only Sole Source aquifer in Oklahoma

(the aquifer supplies at least 50% of the drinking water in the area and users have no feasible alternative source)

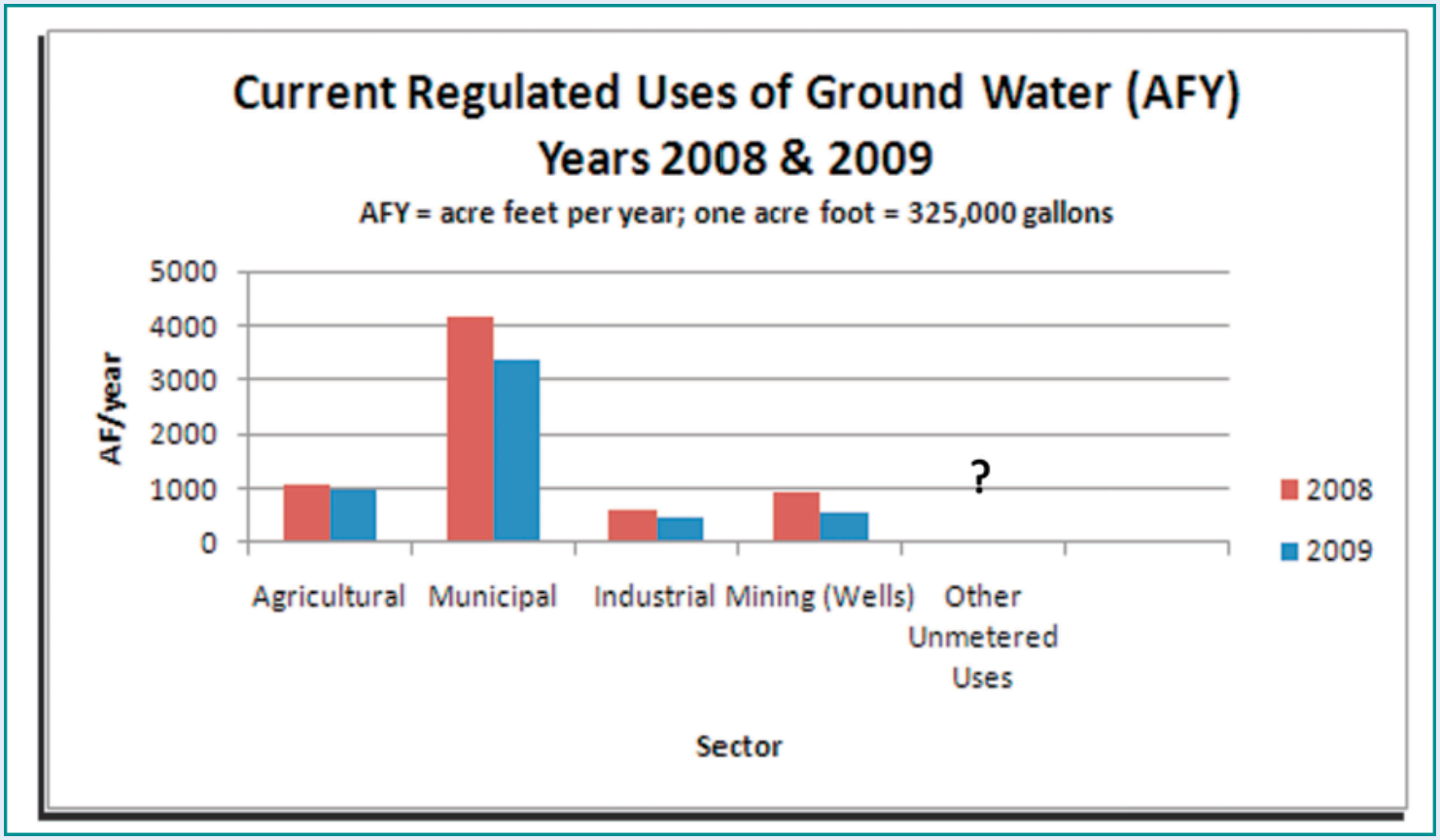
Arbuckle Simpson Aquifer and Surrounding Communities



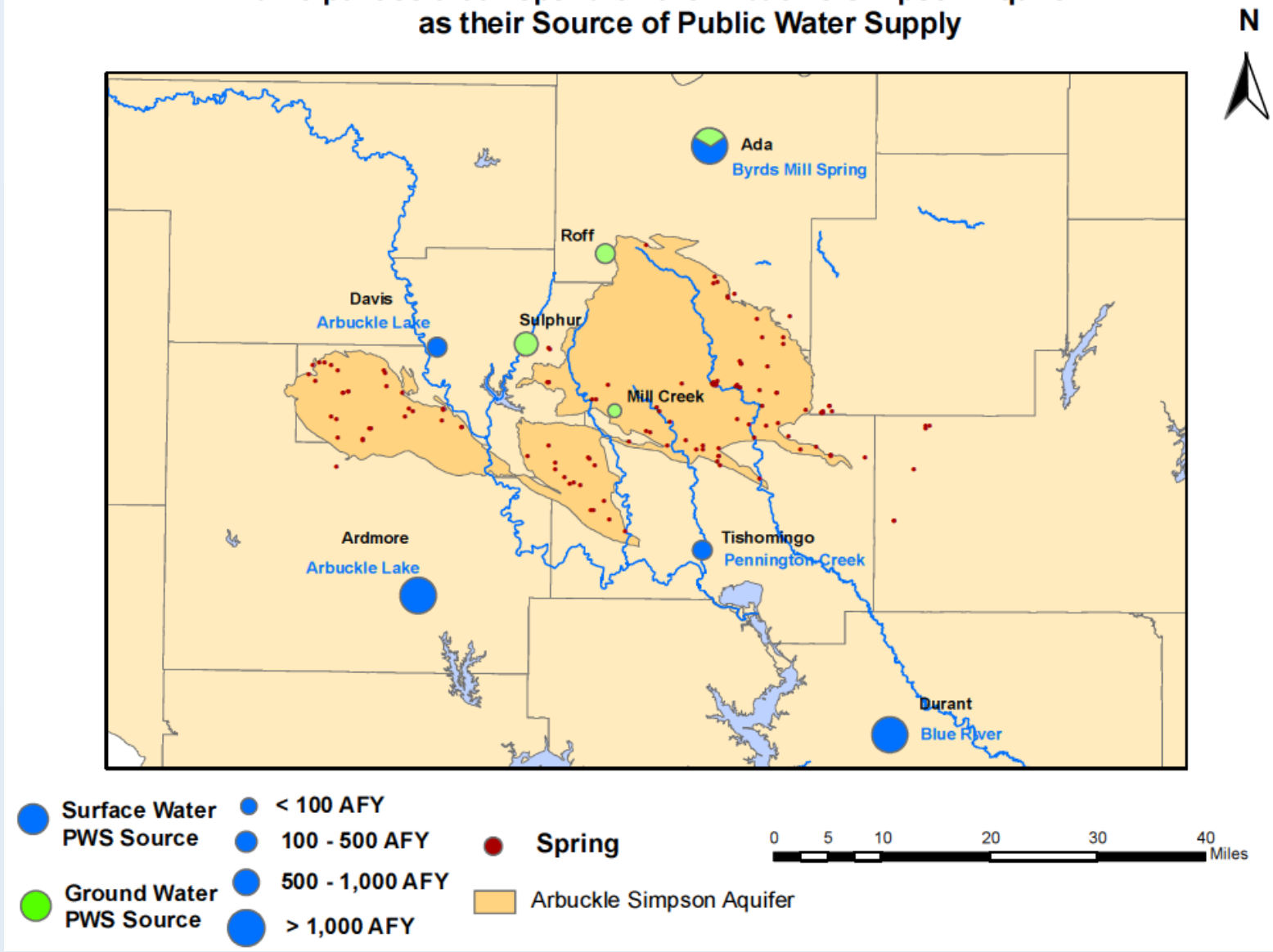
Arbuckle Simpson Groundwater Uses

OWRB study: approx. 25,000-30,000 AFY sustainably available

Primary use is municipal, **as appropriate for a sole source aquifer**—approx. 5,000 AFY



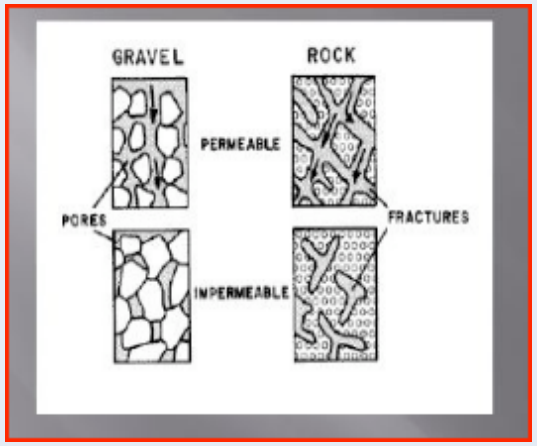
Municipalities that Depend on the Arbuckle Simpson Aquifer as their Source of Public Water Supply



Water is Important in this Region for Recreation & Tourism

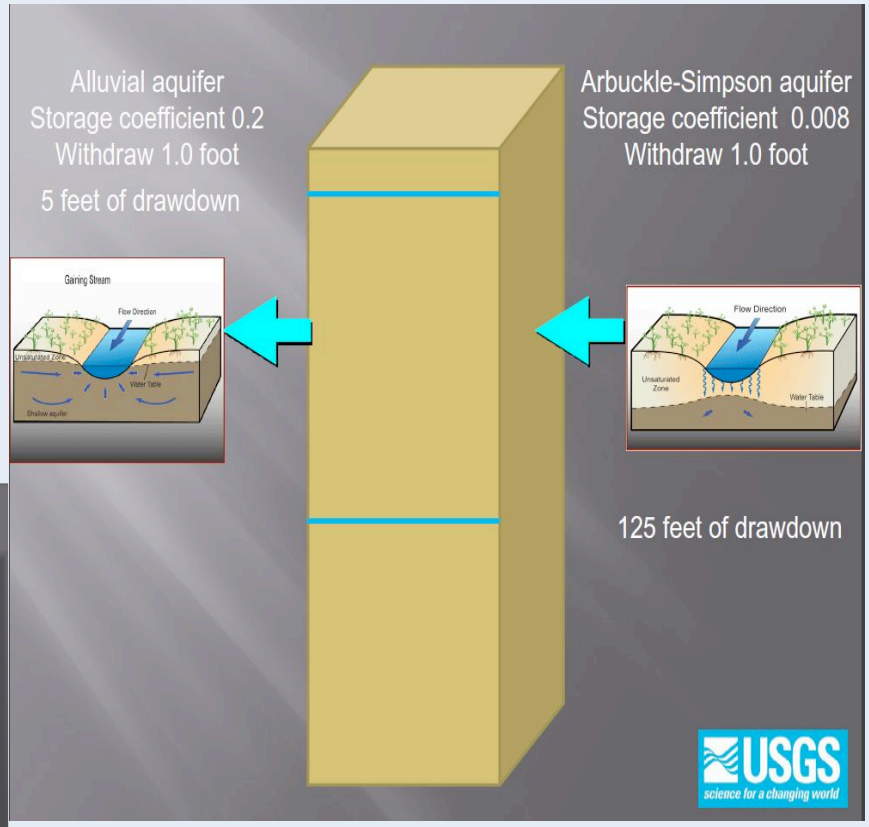
Blue River state wildlife management area, Chickasaw National Recreation Area, Tishomingo NWR, Fish Hatchery, Turner Falls, The Nature Conservancy's Pontotoc Ridge Preserve and others—the hunting, fishing, hiking, wildlife observation, inn and hospitality services collectively draw millions of visitors each year, making a substantial contribution to the local economy.

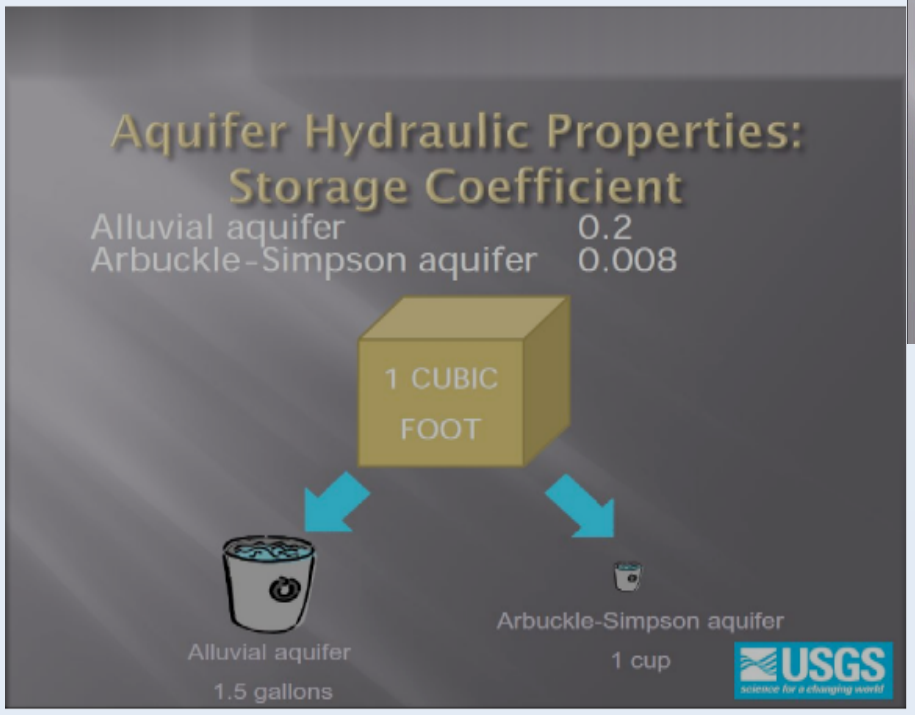
Not All Aquifers are the Same



The unique features of the Arbuckle Simpson Aquifer (ASA) make it less absorbent and more fragile than more typical“alluvial” aquifers that are less rocky.

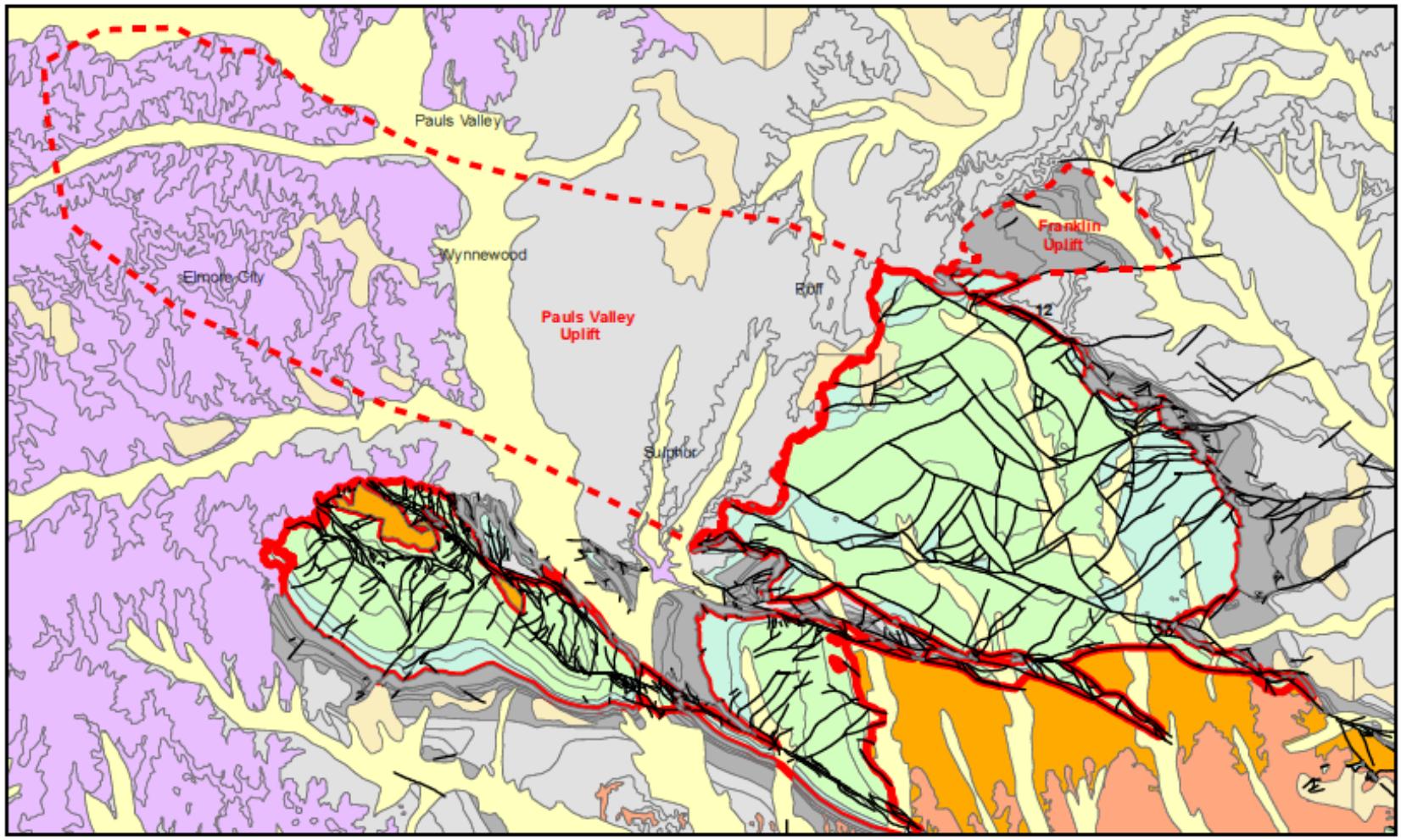
Very different effects of removing 1.0 ft surface water from aquifer.





The ASA absorbs far less rainwater than an alluvial aquifer.

Geology of the Arbuckle Simpson Aquifer and Surrounding Area



Legend

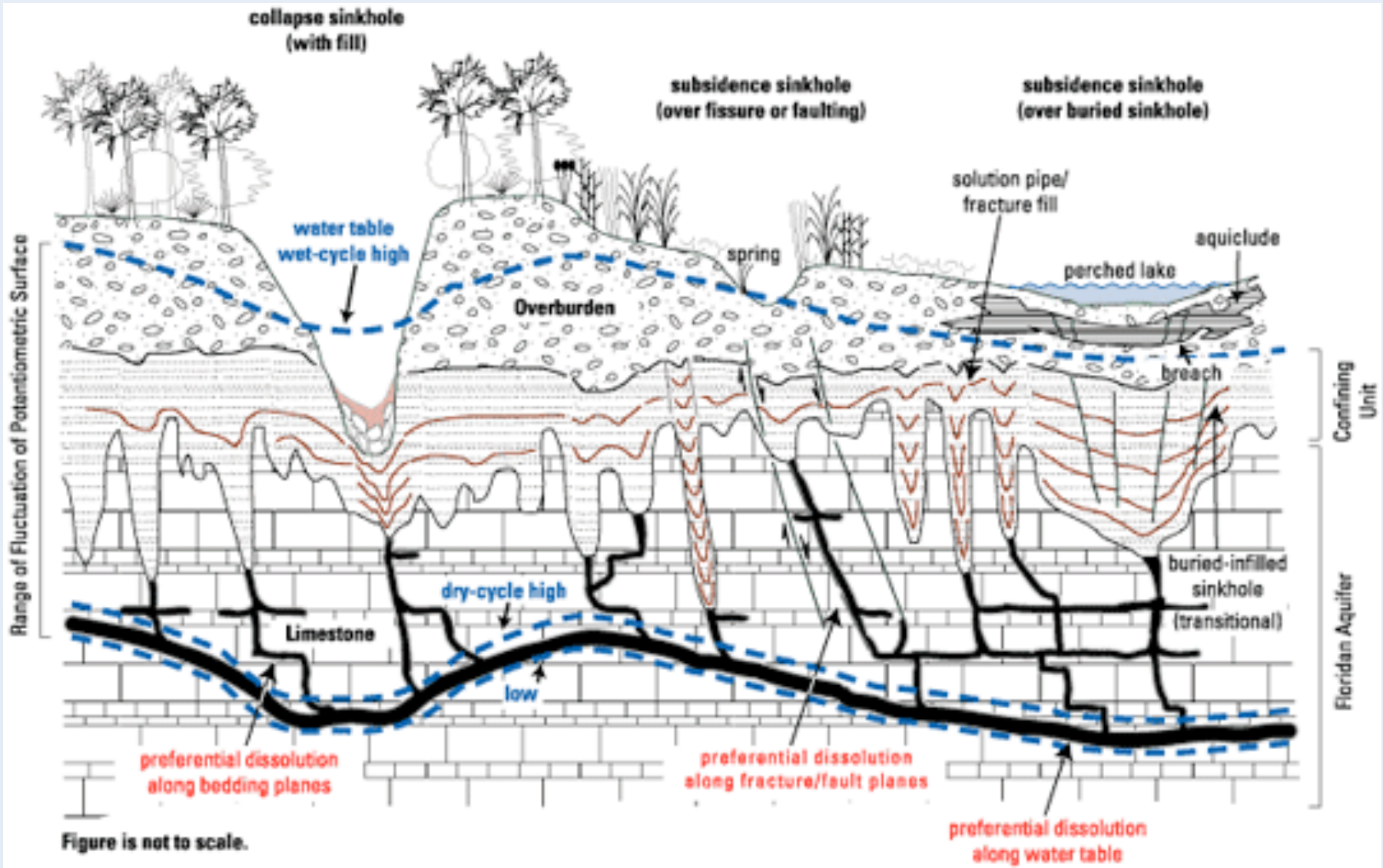
- okcities
- Fault Line
- lakes

Legend

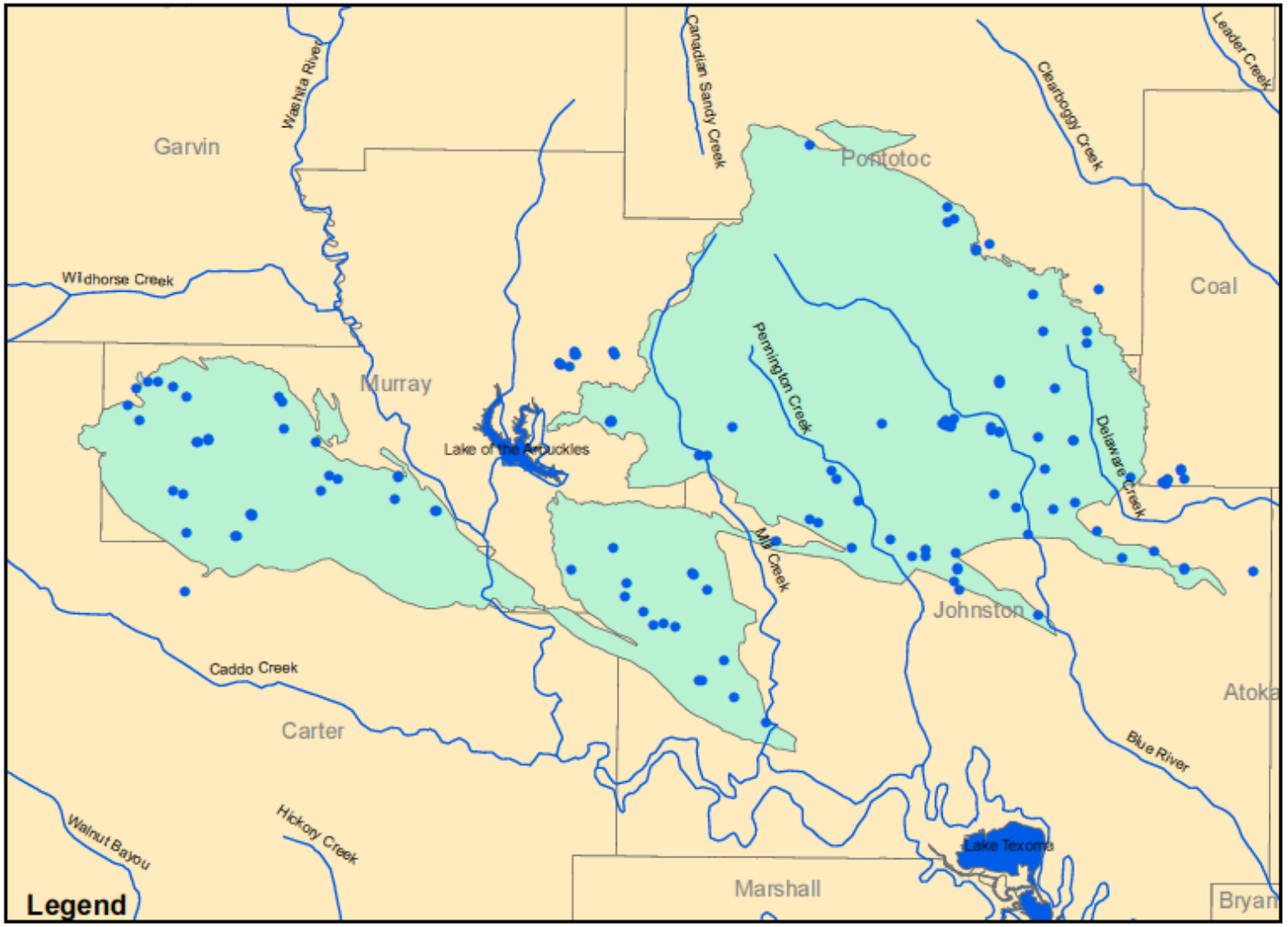
- Alluvium
- Cretaceous Fm
- Permian Fm
- Pennsylvanian Fm
- Silurian, Devonian, Mississippian Fm
- Simpson Formation
- Arbuckle Formation
- Granite

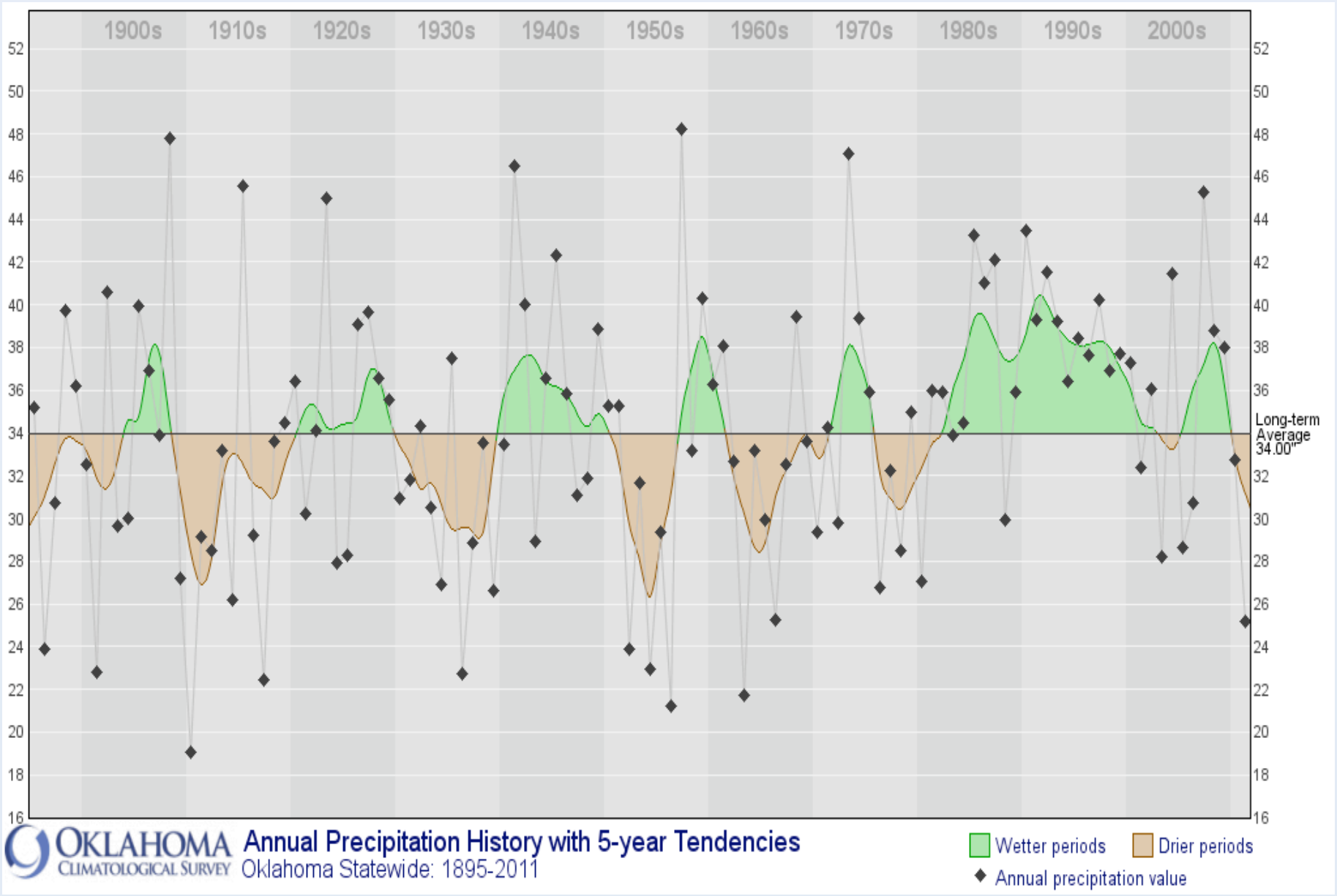
0 2.5 5 10 15 20 Miles

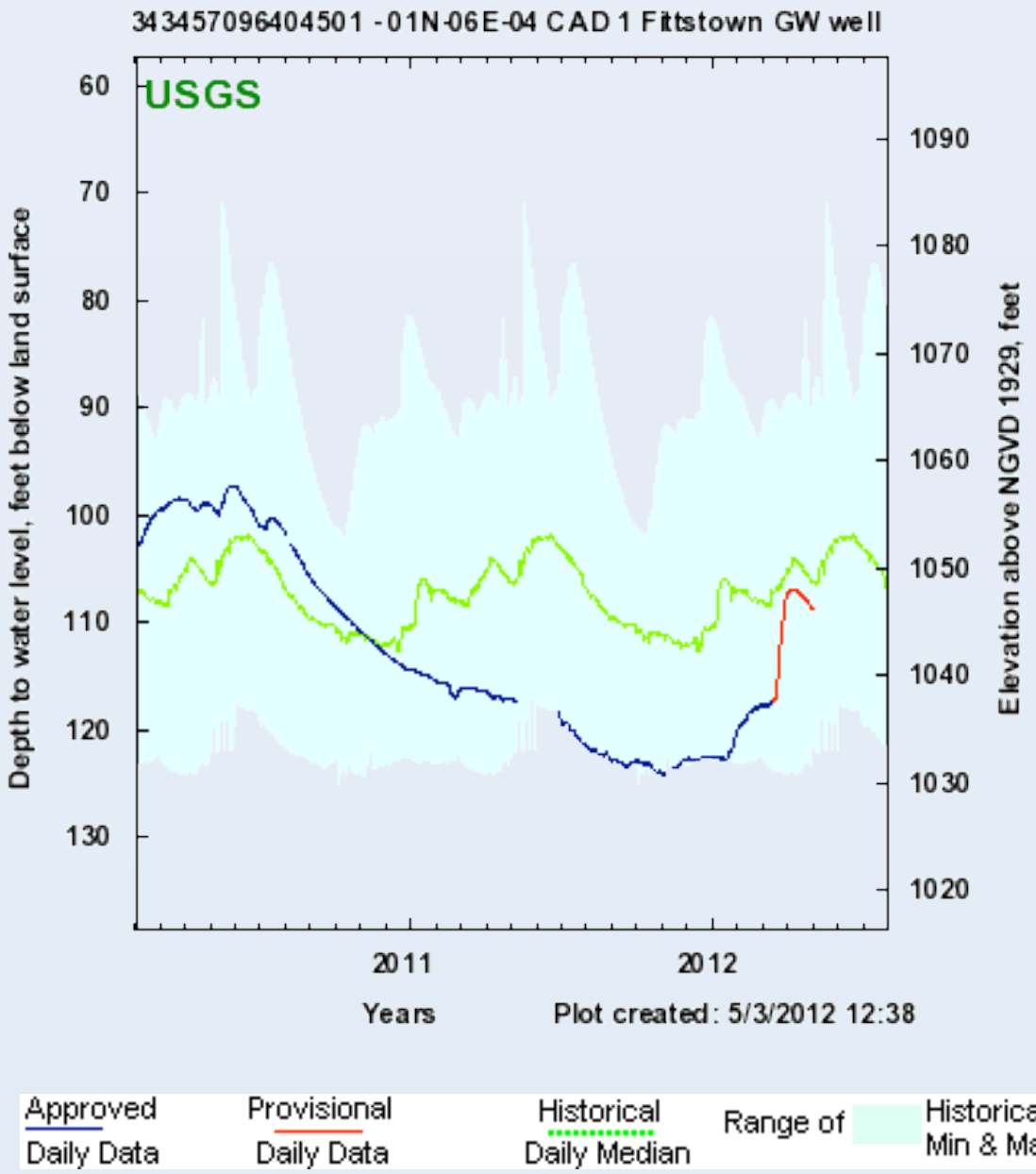
Typical Cross-section of Karst Topography



Springs & Rivers that Flow from the Arb-Simp Aquifer

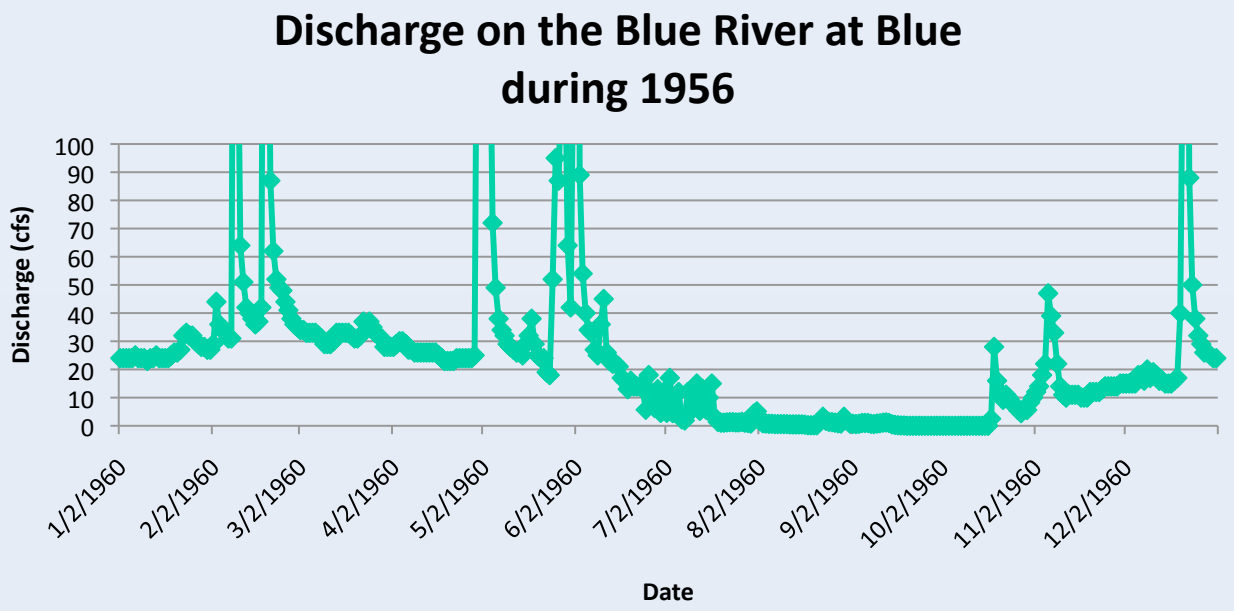



1900s
1910s
1920s
1930s
1940s
1950s
1960s
1970s
1980s
1990s
2000s
52
50
48
46
44
42
40
38
36
34
32
30
28
26
24
22
20
18
16
Long-term Average 34.00"
OKLAHOMA CLIMATOLOGICAL SURVEY
Annual Precipitation History with 5-year Tendencies
Oklahoma Statewide: 1895-2011
Wetter periods
Drier periods
Annual precipitation value



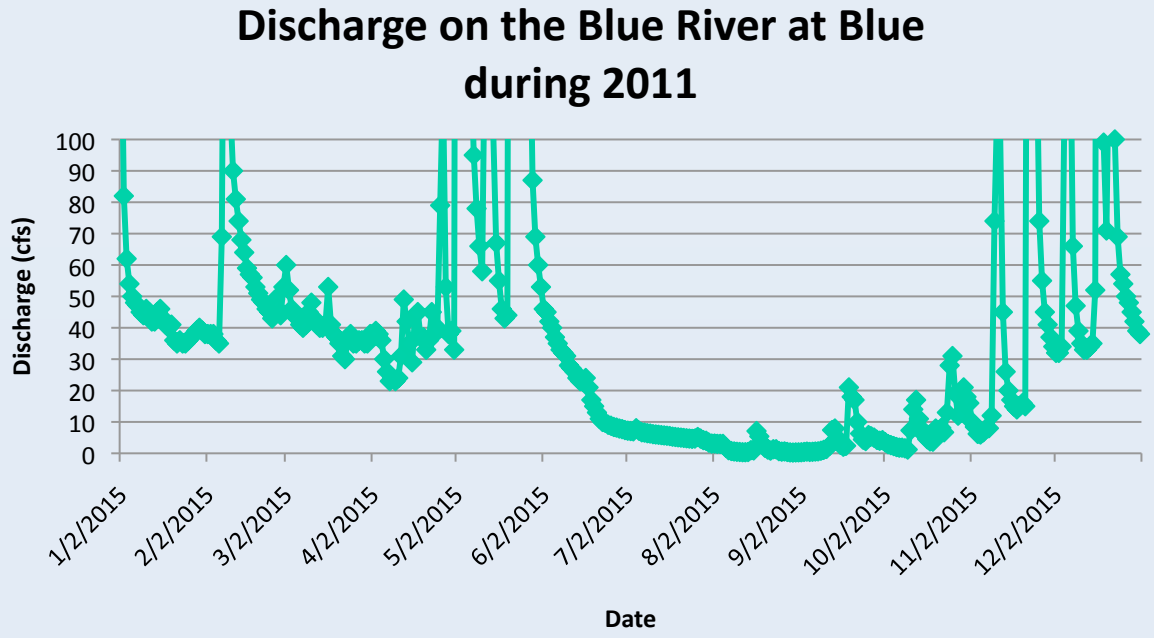
Water levels in the aquifer were at historic low levels during the drought of 2011, but have rebounded to near normal levels with recent rains.

A low water level in the aquifer means less flow at the springs and therefore, less base flow in the streams.



During the worst drought on record in 1956, the Blue River at Blue had 28 consecutive days with no recorded flow.

The flow rate on the Blue River at Blue dropped below 1 cfs for 25 days during the worst portion of the 2011 drought.



Chickasaw National Recreation Area

The Chickasaw National Recreation Area (CNRA) posted signs warning people to stay out of stagnant water pools when the spring-fed creeks in the park stopped flowing during the 2011 drought.

Resources

- U.S. Drought Portal
  - http://www.drought.gov
- Southern Plains Information & Past Webinars
  - http://www.drought.gov/portal/server.pt/community/southern_plains
- Drought Impact Reporter
  - http://droughtreporter.unl.edu/
- State Climatologists
  - http://www.stateclimate.org/
- National Drought Mitigation Center
  - http://drought.unl.edu/
- Southern Climate Impacts Planning Program (SCIPP)
  - http://www.southernclimate.org/
  - Youtube: http://www.youtube.com/user/SCIPP01
- Climate Assessment for the Southwest (CLIMAS)
  - http://www.climas.arizona.edu/

We are now on facebook!
Southern Climate Impacts Planning Program

Is drought properly classified in your region? If not, let us know!

- Drought Impact Reporter
- Contact your State Climatologist
- E-mail the DM Authors: droughtmonitor@unl.edu